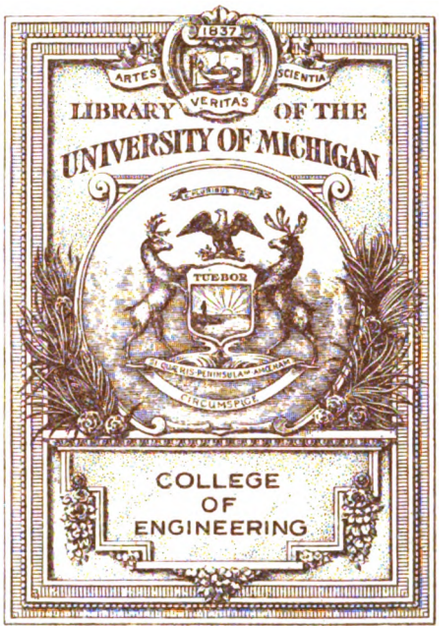
The automotive manufacturer



ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Durant Motors Corp., 1761 Broadway, New York, has awarded contract to the Christian Construction Co., South Bend, Ind., for its proposed automobile manufacturing plant at Lansing, Mich., estimated to cost about $3,000,000 with equipment. A large portion of the works will be given over to assembling, and a machine shop and metal working building will be included in the group of structures to be erected. The plant will be known as the Edward Ver Linden Division of the corporation, and is expected to give employment to over 2,500 men. It will be operated in conjunction with the asembling works at Long Island City, N. Y., comprising an eight story building, recently acquired, and now being remodeled at a cost of about $200,000. Construction of the Lansing plant will begin at once and it is planned to have the works ready for operation by the end of the year. W. C. Durant, president of the dompany, and D. A. Burke, president of the Sheridan Motor Car Co., Muncie, Ind., have acquired the Sheridan property from the General Motors Corporation and this plant it is said, will be operated as a division of the Durant Motors Corp. The purchase, including plant and equipment, involves about $5,000,000.

Racine Engineering Co., Racine, Wis., manufacturer of tractors, has decided to relocate in Sheboygan, Wis., and will be incorporated at once as the Dodge-Sheboygan Co., with a capital stock of $100,000. The product is known as the Dodge Universal Trac-Trac, being a combination machine designed for the work of a motor truck, farm tractor, field hauler and cultivator. It is intended to erect a one story brick and steel shop building, 60 x 150 ft., as the first unit of the new work, to be ready about September 1. A. Y. Dodge is president and chief engineer.

Oshkosh Tractor Co., Oshkosh, Wis., a new corporation with a capital stock of $1,500,000 preferred and 15,000 shares of common stock without par value, has engaged Auler & Jensen, local architects, to prepare plans for a one story brick concrete and steel machine shop and assembling floor, 150 x 500 ft., to cost about $175,000. It is taking over the entire business of the La Crosse Tractor Co., LaCrosse, Wis., and it is hoped to effect the transfer by Sept. 1. A. D. Paine, 22 East New York avenue, Oshkosh, is representing local interests.

Biggam Trailer Co., 802 First Wisconsin National Bank building, Milwaukee, organized several months ago with a capital stock of $200,000, is considering tentative plans for a factory. Since organization its production has been handled under contract with existing shops. Details of the new construction and equipment project have not been divulged. H. F. Biggam is president and general manager.

Ford Motor Co. will probably discontinue the Columbus, O., assembling plant when the new large assembling plant, planned at Hamilton, is completed. The Hamilton plant will be started soon and will cost $400,000. It will have a capacity of 30,000 cars yearly. In the event that no changes are made in the plans both the Columbus and Cincinnati plants will be merged into the one at Hamilton.

Midland Tractor Co., Milwaukee, has been incorporated to manufacture tractors, trucks and similar commodities. The capital stock consists of $250,000 of preferred stock and 600 shares of common stock without par value. The incorporators are P. B. Brueckbauer, Arthur Wickham and Howard T. Foulkes, attorneys, 500 Sentinel building, Milwaukee.

Garford Motor Truck Co., Lima, O., has completed a modern progressive assembly plant and office building. The new unit brings the factory floor space up to 14 acres and will more than double the production capacity. The building, two stories high, is constructed of concrete, steel and glass. The assembly division is 420 ft. x 100 ft.

Romer Motors Corp., 55 Cornhill street, Boston, has preliminary plans under way for its new automobile assembling plant on Water street, Danvers, Mass., comprising three one story buildings, 100 x 800 ft., 100 x 500 ft., and 50 x 100 ft., to cost about $100,000 with equipment. Albert J. Romer is president and general manager.

Atlas Tractor Co., Adrian, Mich., is reported to be arranging for the erection of its proposed new tractor manufacturing plant at Belleville, Mich., instead of Adrian, as originally projected. The Adrian site, upon which preliminary foundation work has been done, will be abandoned, it is said.

Durant Motor Co. of California has been founded by W. C. Durant, president of Durant Motors, Inc., 1764 Broadway, New York, and other officials of that corporation for the establishment of a Pacific coast plant at Oakland, on site now being selected. Plans of the structure are under way.

General Motors Corp. is transferring the major part of the Samson truck operation from the Samson works at Flint, Mich., to the vast tractor and implement works operated by the Samson Tractor Co. at Janesville, Wis. Parts will continue to be made at Flint.

Sheridan Motor Car Co., Muncie, Ind., recently purchased from the General Motors Corp. by interests headed by W. C. Durant, will not make actual transfer of the plant until August 1. General Motors will continue production of the present models until that time.

Agrimotor Mfg. Co., Wichita, Kan., manufacturer of farm tractors, road building machinery, etc., has plans under way for a new two story plant at Ninth and Illinois streets, Joplin, Mo., to cost about $100,000, with machinery. C. W. Lewis is president.

Eagle Motor Truck Co., 6154 Bartmer avenue, St. Louis, has acquired a local site for the erection of its new one story plant, 50 x 100 ft., estimated to cost about $50,000 with machinery. Plans for the structure are being prepared.

Henry Ford, Detroit, is reported to be negotiating for the purchase of three large buildings at the government nitrate works at Sheffield, Ala., to be used as a local plant for the manufacture of Ford automobiles and Fordson tractors.

H. B. Young Motor Truck Co., Euclid, O., has acquired a factory at Geneva, for the establishment of a new plant to manufacture motor trucks and parts. The Geneva Chamber of Commerce is interested in the project.

Industrial Motor Truck Co., West New York, N. J., has been incorporated with a capital of $100,000 by Ragna Johnson, Albert J. Manetti and J. V. Waldy, 159 Seventeenth street to manufacture automobile trucks and parts.

Aero Mfg. Co., Newark, N. J., has been incorporated with a capital of $250,000 by Victor W. Fitch, Ernest O. Dick and Lloyd G. Beatty, 142 Market street, to manufacture aeroplanes and parts.

Paragon Motor Car Co., 133 Baltimore street, Cumberland, Md., will establish a plant, 300 x 274 ft., for the manufacture of motor vehicles. It was recently organized with P. W. Blake president.

Fairmont Carriage & Automobile Works, Fairmont, W. Va., is planning to rebuild the portion of its plant recently destroyed by fire with loss estimated at about $70,000, including equipment.

Premocar Automobile Co., 2109 Olive street, St. Louis, has been organized to manufacture automobiles and parts. William Piskulic is president, and E. A. Rotaylk secretary and treasurer.

Buffalo Truck & Tractor Corp., 37 Carolina street, Buffalo, has awarded contract for a new one story plant at Clarende, N. Y., 60 x 400 ft.

Big Four Motors Co., Sacramento, Cal., is considering the erection of a new plant at Richmond for the manufacture of motor trucks.

Body Builders

Smith-Springfield Body Co., Springfield, Mass., will increase its plant capacity 50 per cent and 100 additional men are to be employed. Construction of a new unit 90 x 220 ft. will be completed in June. Completion of this building will double the size of the plant. The company has recently obtained contracts for closed car construction from the Wills Sainte-Claire and Mercedes companies. It has been making closed and touring type bodies for Rolls-Royce of America, Inc., Stevens Duryea, Marmon, Lincoln and the Citroen company.

Milburn Wagon Co., Toledo, will increase the common stock of the company from $625,000 to $1,000,000 for the purpose of absorbing the accumulated surplus. The company will put on about 600 men in order to bring its production of bodies for the Olds Motor Co. up to schedule. There are now 220 men employed in the production of Milburn electrics. The schedule calls for about four cars a day.

Holbrook Co., buidler of custom built automobile bodies, has removed its plant from New York city to Hudson, N. Y. The removal of the plant has necessitated suspension of operations for the past sixty days. In the new factory, the company will be able to operate on a larger scale with better facilities.

H. McFarlane & Co., who have made wagons since 1854, and are said to be the oldest wagon manufacturers in the middle west, have purchased a site 150 x 116 on Green street, north of Van Buren, Chicago, and will build a six story $440,000 plant for the manufacture of automobile bodies.

Fisher Body Corp. Detroit, report for the year ended April 30 shows net profits after all expenses, losses, interest charges, depreciation and Canadian income taxes of $4,809,948, establishing a new record. Earnings for the previous year were $4,378,000.

United Motor Truck Body & Cab Co., Glenwood, Wis., has been granted a charter to manufacture commercial car bodies, truck cabs, etc. The capital stock is $50,000 and the incorporators are Charles Preeshl, Ray B. Lightfoot and Frank J. Preeshl.

New Jersey Commercial Body Co., Burlington, N. J., has acquired the one story and basement building at 237-49 Elizabeth avenue, Newark, on a site 140 x 150 ft., for the establishment of a new plant. The company is headed by S. A. Neidich.

Johnson Auto Body Corp., Boston, has been incorporated with a capital of $300,000 to manufacture automobile and truck bodies. Henry C. Johnson, 336 Metropolitan avenue, is president and treasurer; H. A. Johnson and C. E. Wheeler are directors.

General Motors Corp. is considering a plan of manufacturing custom built bodies at the plant of the Dayton-Wright Airplane Co. The plant is not large enough for quantity production but it offers excellent facilities for custom work.

Robertson Carburetor Co., Ninth street and Second avenue, Birmingham, Ala., has awarded a contract to F. E. Russell, Birmingham, for a new one story plant to manufacture carburetors and other ignition equipment.

Birmingham Auto Body Co., Birmingham, Ala., has leased a two story brick building to be erected on a site, 50 x 140 ft., for the establishment of a new automobile body manufacturing works.

Perth Amboy Auto Body Co., Perth Amboy, N. J. has been incorporated with a capital of $50,000 by John Joswick, Jr., and Louis Y. Sosin, 217 Smith street.

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. XLIII., No. 3 NEW YORK, JUNE, 1921 $2.00 Per Year Issued Monthly

Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City.
Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3, 1879

The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

Vol. LXIII NEW YORK, JULY, 1921 No. 4

Airplanes Partly Successful in War Bombing Tests

Government Bombing Machines Very Successful on Submarine and Destroyer But Unsuccessful on Battleship—Further Tests Needed—Manufacturing the Huge Planes

GREAT public interest attached to the recent tests held jointly by the U. S. Army and Navy Departments in which the object was to determine the relative value of aircraft in warfare, which will determine incidentally whether or no the battleship has been rendered obsolete through the development, present and to come, of bombs, bombing tactics and serial bomb-carrying machines.

The Army interest in the test was concerned with the aerial side, a number of Army machines, both airplanes and blimps, participating. The tests began June 21, off the Virginia Capes, with the former German submarine U-117 as a target. The object of this test was to determine the possibilities of aircraft attacking and sinking such craft using the 250-pound bombs. This first test resulted in a remarkable showing for the aircraft, the vessel being sunk within ten minutes. Only twelve bombs were dropped, in two salvos, the first of three scoring no direct hits, while the second salvo of nine bombs was more successful.

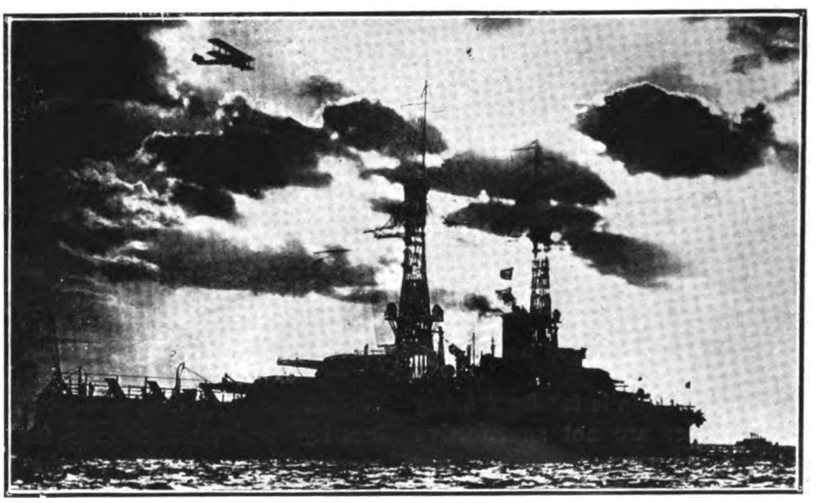


Fig. 1. Newest type Martin Bomber, which carries 3,000 lbs. of bombs over a radius of 500 miles at a speed of 100 miles per hour. Shown above battleship.

The air forces designated to attack the U-117 consisted of eight divisions of naval flying boats and marine airplanes, totalling twenty-four machines, and twenty-three Army airplanes, or forty-seven aircraft all told. The naval and marine air forces which were to bomb the submarine first consisted of three divisions of F-5-L flying boats (nine machines), two divisions of NC flying boats (four machines), one division of Glenn Martin bombers (five machines), and one division of DH-4 airplanes (six machines). If they had failed to achieve any result, the Army bombers were to try their hand. The pilots were allowed to attack the target in any manner of formation and at any level consistent with safety.

For the purpose of the test the U-117 was anchored to buoys 60 miles off the Virginia Capes. The U-boat, which was one of a number surrendered by Germany after the armistice, was 267 feet long and had a surface displacement of 1,164 tons.

The bombing test officially commenced at 9 A. M., when the first naval seaplane division of three F-5-L flying boats, under Lieut. D. Thomas, U. S. N., took off from Hampton Roads and headed for the position of the submarine. At 9:59 A. M. the division was sighted by the vessels of the Atlantic flet which were standing by around the U-117, and at 10:23 A. M. the three flying boats let go a first salvo of three 163-lb. Mark IV bombs from an altitude of 1,000 feet. No direct hit was registered, but the target was well bracketed for one bomb fell close to the submarine on the port side while the other two bombs hit to starboard. The seaplanes thereupon made a large circle and headed back upon the target. At 10:32 they let go a second salvo, of nine

bombs this time, and two of these scored direct hits just aft of the conning tower. The remaining seven bombs hit in close proximity of the target. Six minutes later the U-117 sank by her bows.

The second part of the test took place June 29, when the radio-controlled battleship Iowa simulated a hostile approach to the American coast. A scouting squadron of blimps was stationed 50 to 100 miles off shore to discover the enemy and signal her position to the shore stations. These consisted of the Langley Field Army base on Chesapeake Bay, Army sub-bases at Chincoteague just at the northern Virginia line, and False Cape just at the Virginia southern line, and the Navy base on the U. S. S. Shawmut anchored just inside the mouth of Chesapeake Bay.

Twenty planes participated, making a total of 57 separate attacks, all dropping a total of 80 bombs ranging from the 193-pound missiles carried by the F-5-L seaplanes to the 500-pounders carried by the Martin bombers. The results were anything but satisfactory to the airplane adherents for but two direct hits were made and neither of these did any appreciable harm to the battleship. Other tests of a similar nature, which are to follow with the former German cruiser Frankfurt and battleship Oestfriesland July 18 and 20 respectively, will help to prove whether the apparent conclusions of this first test, namely that the battleship is far from being obsolete, and that bombing planes are not as effective attacking units as was claimed, are correct.

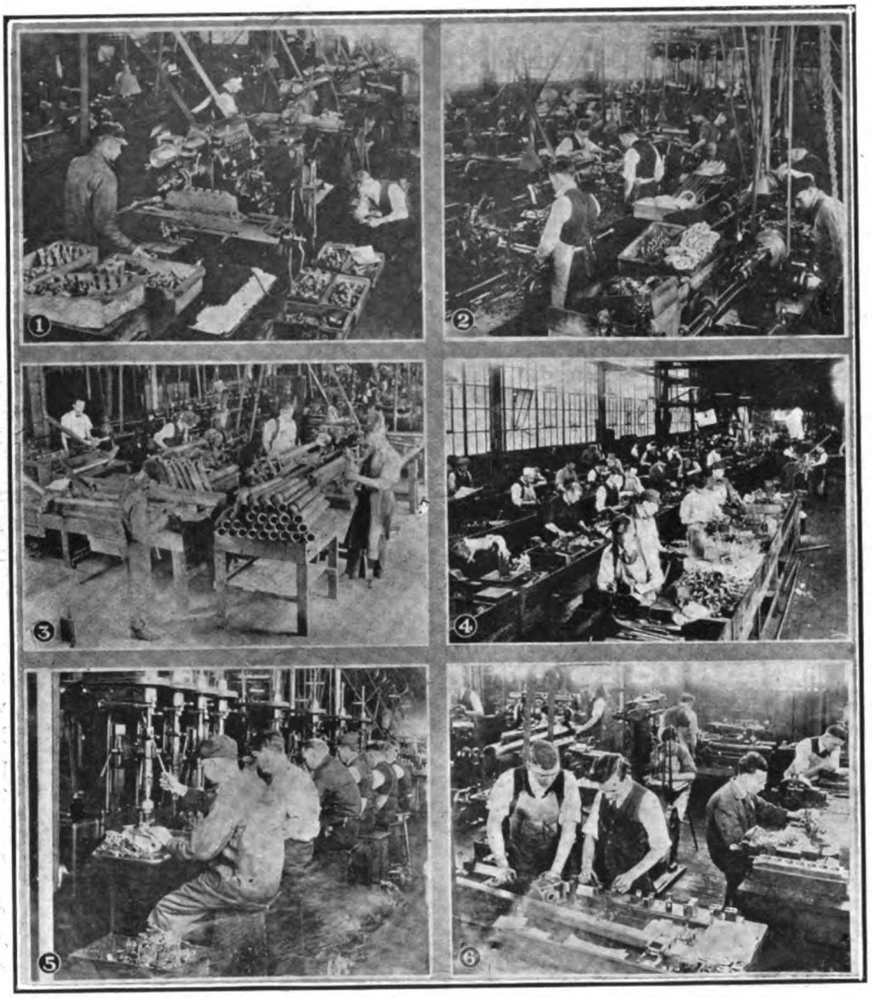


Fig. 2. Views in Metal Dept. of factory producing Martin Bombing Planes.

The interesting feature of this test was in its control by radio, and this was extremely effective. Experts agree, in fact, that had the battleship been stationary it would have been wrecked.

The bombing of the Iowa was postponed a day on account of adverse weather conditions at sea.

All day June 28 the Pennsylvania, Henderson and other craft, after picking up the Iowa and Ohio, steamed very slowly due southwest and then doubled around in a southwestern circle to the point 55 miles off the Maryland coast where the ten units were lying at 8 o'clock this morning. As early as 5:30 June 29 the air officers on the Shawmut, 70 miles east of Cape Charles, who did not know the position of the Iowa, sent word shoreward for the army blimps to proceed seaward, as weather conditions would make the postponed test possible.

The noses of all the vessels around the Iowa pointed northwest when they started shoreward at 8 o'clock and the ten ships maintained their same relative formation while zig-zagging slowly shoreward during the attacks.

After sighting the Iowa at 10:10 o'clock, the D-2 was flying over the target three minutes later. Both from that time on hung around astern of the Iowa, but out of the path of the planes, which were due to come into sight any moment in response to the D-2's broadcast notification by radio that contact had been established with the "enemy."

At 10:51 the first plane was sighted. It was a seaplane, one of the F-5-L's belonging to the Cape Henlopen division.

The blimps, after sighting the Iowa, had to estimate her location by dead reckoning, and signaled the Shawmut and neighboring planes that the Iowa was in "Square 30" on the navy's squared chart of the Atlantic. As a matter of fact, the Iowa was on the boundary line between Square 17 and 23, about 15 miles northwest of "Square 30," and the first broadcast notification of contact was misleading by 15 miles. But the location was near enough for fast-traveling planes to correct the error and find the Iowa.

After the D-2 first began signaling the Shawmut the latter broadcasted the news of contact to all planes at sea and to the bombers held in reserve back at shore bases at Yorktown, Hampton Roads and the Capes.

Within a very short time the first plane was sighted coming down on the Iowa from the north at 10.51, and at 11:05 a second plane arrived around the target. The third plane of this division came up and by 11:21 the trio were circling over the Iowa, studying conditions.

They lost no time in dropping the first bomb at 11.23. It fell two ship's lengths astern of the Iowa, which had

already begun zigzagging. The second bomb fell at 11:29, about 100 feet ahead of the Iowa; the third, at 11:33, fell in the water opposite the Iowa's starboard side. Each of these planes had four 163-pound bombs. They kept circling around, attacking the target in regular turn every few minutes.

By 11:25 the first three planes from Cape Henlopen were joined by two others from the direction of Cape Charles, also F-5-L's. This put five planes in the buzzard-like byplay over the target, with a sixth plane coming up at 11:40 o'clock.

The two divisions continued their attack, each dropping a bomb at a time, until 11:44 o'clock, when the first division of planes, having released all its bombs, soared off toward its Cape Henlopen base.

The bombing was remarkably good, but not good enough to hit the Iowa when she was in motion. First one bomb would drop just ahead of the bow, then one a ship's length astern and others in the water close to the port or starboard sides, without hitting the ship.

While the 367-foot Iowa offered a comparatively small target, it was moving very slowly and covered but 15 miles in an air line during the 3 hours the test lasted, although zigzagging continuously and probably traveling a total of twice this distance or more.

A good check on the early results was obtained on July 13, when Army machines attacked the former German destroyer G-102, 60 miles east of Cape Charles. The net result was the sinking of the vessel within 20 minutes of the first hit and within 2 hours of the start from shore bases 85 miles away. The attacking squadrons consisted on the Fourteenth Heavy Bombing Squadron, 14 Martin heavy bombers; the Eighty-eighth Squadron, 7 DH 4 B machines; the Fiftieth Squadron, 7 DH 4 planes, and the First Provisional Pursuit Squadron, 11 SE 5 planes, assisted by 2 Caproni, photographic and surveillance planes and 3 blimps, a total of more than 50 units. The Sopwiths (SE 5) carried small 25-lb. Cooper bombs designed to drive the personnel of the destroyer from the decks. Forty of these were dropped, making 20 direct hits.

Differing from the earlier test, the attack by the heavy bombers was made from altitudes of 2,000 to 2,500 feet These machines carried 500-lb. demolition bombs, of which the Martins dropped 44 and the DH's 7. Two direct hits were made and the ship sunk within 20 minutes, so rapidly in fact that the subsequent direct hits could not be noted and recorded. The test was considered remarkably successful by the Army officers in charge, inasmuch as the first direct hit resulted in the destroyer starting to sink so fast that within 8 minutes her decks were awash.

Fig. 3. Assembly Dept. of Martin plant showing stages of plane construction

In this latter test the big Martin bombing machines and their big bombs showed much greater effectiveness than the big naval seaplanes of the F-5-L type. The former have been designed especially for this work, and have been refined considerably in recent years. Incidentally, the Martin firm is turning out one of twin-engine 6-ton machines each week, and delivering the same to the Air Service at Langley Field, Va. In fact the Martin machine has been such an important figure in all these and previous bombing tests that it will be interesting and instructive to look into the factory, its equipment and methods.

The Martin factory is a specially designed pavilion type steel, brick and glass structure of 72,000 sq. ft. floor space, situated on one end of a L-shaped flying field containing 70 acres of land, in the heart of the East End Cleveland manufacturing center, and is, of course, within easy reach of a large skilled-labor market.

A complete engineering department is maintained for the designing, engineering and production of working drawings of Martin planes. The engineering staff includes a large number of technically trained men of long experience in automotive industries, many of them having devoted themselves entirely to airplane design and construction.

In addition to specializing on airplane engineering and

design, this organization cooperates to the greatest possible extent with the Army and Navy of the United States government in developing the airplane as a military factor.

Upon receipt of blue prints, specifications and releases by the planning department, the functioning of the producing organization begins. This department calculates the quantities of raw materials and standard supplies required; issues detail shop orders to the various factory departments, and keeps a continuous production record of each and every job.

Under the jurisdiction of the treasurer is maintained a cost accounting department which accumulates all production costs of orders issued from the planning department.

It is interesting to note that the company has a well organized fire department, the members of which are from the various departments and are drilled in the use of the equipment supplied for the protection of the company's properties. The factory has the usual sprinkler system installed, with a 50,000 gal. reserve water tank; also, chemical extinguishers are installed in the various departments.

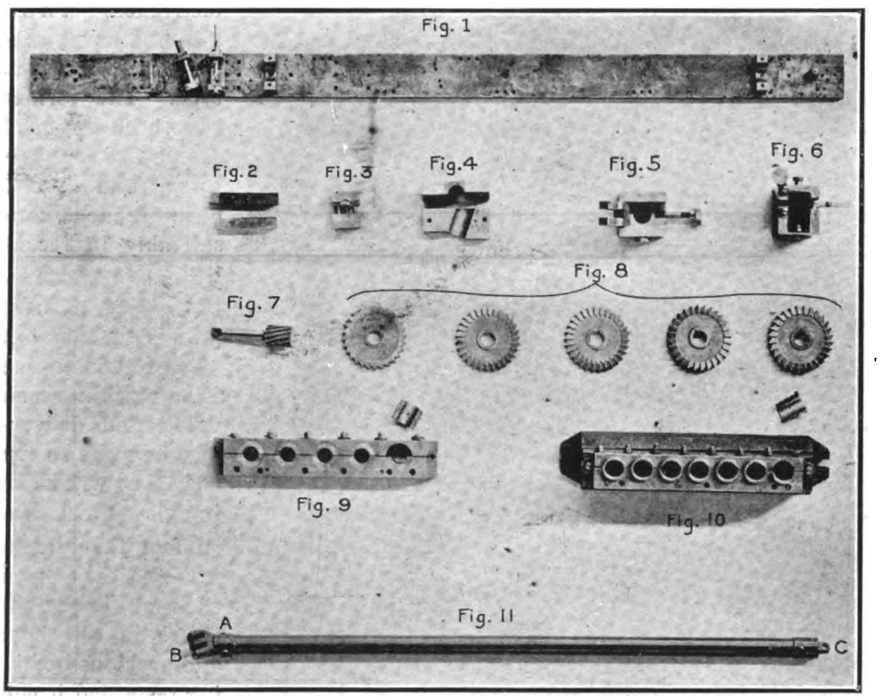


Plate 1. Bombing machine assembly and tools required in its production.

A well regulated cafeteria is located in the center of the factory where meals are served to all employes at cost. The cafeteria management also conducts a cooperative service for purchasing groceries in large quantities which are sold to employes at cost.

The entire factory and its equipment has been so laid out that plant departments can be expanded, with practically no disturbance to the existing departments, at a minimum cost.

The accompanying illustrations show the various departments of the Martin plant.

It will be equally instructive to look into the detail parts used, and the methods followed in the shop for producing and insuring their accuracy, since in the last analysis the man in the air is wholly dependent for his satety upon the accuracy of the machine's parts.

With the exception of the parts required for the motors, radiators, wheels, propellers, instruments and armament, and not including the necessary screws, tacks, nails, cotter pins, cloth, thread, tape, dope, varnish and enamel used, the latest type of Glenn L. Martin Bomber contains 24,948 detail parts of which 11,385 are detail metal parts. Of these 11,385 detail metal parts 75 percent require special tools. After their manufacture, these 11,385 detail parts are assembled to form 1,731 unit metal assemblies of which 50 percent require special assembly tools and fixtures.

Two striking examples of Martin Bomber metal assemblies are illustrated here, together with the tools and fixtures required in their manufacture. Plate 1 shows one of the several engine nacelle brace tubes (Fig. 11) which is composed of two nickel steel tube ends riveted and brazed into each end of a 2-inch diameter by 16 gage nickel steel tube. The position and function of this assembly in the plane necessitates accuracy within four thousandths of an inch in length from center to center of the pin holes in the tube ends. This precision is obtained by assembling the tube in the assembly fixture (Fig. 1). The assembly fixture duplicates the manner in which the tube is attached in the plane by holding the tube at each end by a pin through the hole in each tube end. The detail parts of the assembly are assembled in the fixture, pinned in place, and are then taken out, riveted and brazed. This same fixture (Fig. 1) is also used by the inspectors for checking the parts before they are released for use in the ship.

Two forged forming tools (Fig. 2) are used in a turret lathe to form the end of the small tube end (C-Fig. 11). Practically all of the tube ends on the plane are so designed that they can be thus formed. A milling collet (Fig. 3) is used to mill the concave washers (A-Fig. 11) after they are stamped out. A pair of vise blocks (Fig. 4) are used for two of the milling operations on the large tube end (B-Fig. 11). A drill jig (Fig. 5) is used for drilling the pin hole in the small tube end (C-Fig. 11). The pin hole in the large tube end is also drilled in a drill jig (Fig. 6). Due to the length of this hole it is drilled from both ends. The milling cutters (Figs. 7 and 8) are all high speed steel, and are used in the milling operations on the two tube ends. An extra set of blocks and bushings (Fig. 9) are used in connection with the milling fixture (Fig. 10) which has a set of block sand bushings mounted. This fixture is used for milling the tube ends (Fig. 11), and by changing blocks or bushings, or both, can be adapted to the milling of practically every tube end manufactured by the Glenn L. Martin Company.

Plate 2 shows one of the principal fuselage fittings (Fig. 21) which supports the landing gear at (A), and which also acts as a bearing [through the large center

holes (B)] for the tie tube (not shown) across the bottom of the fuselage. The tie tube carries a large tube-end at each end which in turn supports the front of the lower inner wings. This fitting (Fig. 21) consists of a sheet steel body cut out to template (Fig. 9) and bent as shown (Fig. 21). Reinforcement fittings are spot welded and brazed to the sheet steel body as well as two clips (C-Fig. 21) which support a wooden strut that spans the fuselage at that point. A heavy nickel steel fitting (A) is riveted and brazed to the bottom of the body which carries he landing gear. This fitting is made from solid bar steel. A large pin, bearing in the hole, through the heavy ears in the nickel steel fitting, is milled and drilled in the center to engage the tube end on the landing gear sway brace (not shown).

The steel block (Fig. 1) over which the sheet steel body is bent to shape and upon which the large holes are bored in a milling machine with a cutter, which is previously located by the hole in the block. A radius punch and die (Figs. 12 and 2, respectively) are used to cut to length and shape the clips (C-Fig. 21). Strip stock is used and by means of an adjustable stop on the die, this tool can be adapted for blanks of various lengths and of a width given by twice the radius of the die. A drill jig (Fig. 3) is used for drilling and reaming all the holes in the fitting that supports the landing gear (A-Fig. 21). High speed steel milling cutters (Figs. 4, 5, 6, 7, and 8) are used for the various milling operations on the fittings and a milling fixture (Fig. 10) and special clamp (Fig. 16) are used for milling.

A combination templet and drill jig (Fig. 9) with inserted hardened tool steel bushings, is used for laying out and drilling the sheet steel body. All the holes are drilled in the flat as the jigs for drilling are much simpler and the parts can be handled more easily. Each hole is drilled to finished size except where washers or reinforcing fittings are brazed on, in which case, the holes are drilled small to allow for drill reaming after the fittings are put on. A combination templet and drill jig (Fig. 13) is used for laying out and drilling the reinforcing fittings plainly visible in Fig. 21. A combination templet and drill jig and punching templet (Figs. 14 and 15) are used for laying out, drilling and punching lightening holes in the clips (C-Fig. 21). A drill jig (Fig. 11) is used for drilling the holes in the pin that engages the landing gear tube end, and small bending blocks (Figs. 17, 18 and 19) are used to bend up the reinforcing fittings and clips. A small block (Fig. 20) is used to space the clips on the sheet steel body when they are being spot welded in place.

Market for American Cars in India

A copy of the motor transport subsidy scheme of India, as of November 1, 1921, states that the government of India proposes to offer owners of certain types of heavy motor lorries, who are prepared to register their vehicles of requisition by the government, at predetermined valuations, in case of need, an annual subsidy, the object being to provide mechanical motor transport service when needed. Indian newspapers are now frequently carrying advertisements of motor trucks with the statement: "These vehicles are built to conform with the Indian government subsidy requirements."

There is at present an oversupply of automobiles in India, writes Trade Commissioner Batchelder. It is estimated by a representative of the automobile industry that out of the 14,032 cars imported into India between April 1, 1920, and January 31, 1921, about 7,000 are stored in Calcutta, Bombay, Delhi, Karachi, and other places awaiting purchasers, and in some cases held for non-payment of drafts by the consignees. The 20 per cent duty on luxuries will tend to stiffen prices and hasten prospective buyers, who have been waiting for a general price cutting. Only a small percentage of the American manufacturers whose cars are seen in India have their own representatives and their trade suffers accordingly, as often the concerns charged with the sales do not understand the automobile business, and also charge excessive prices in order to make a good profit. There is great need for representatives of American automobile manufacturers in India to conduct advertising and sales campaigns adapted to the conditions of the country, and to provide for stocks of spare parts on hand in India. Efforts in this line should be amply rewarded after the present stocks of machines are disposed of and the present general depression is over. There is a market for high grade cars which are fitted up to suit the tastes of the wealthier purchasers, mostly the Indian nobles. As a means of meeting these requirements Mr. Batchelder suggests shipping chassis and having the expensive limousine bodies with special finish and upholstery, made in India.

The potentialities of the market in India for motorcycles is thought to warrant the sending of representatives of American producers who can study the field, writes Consul General Weddell. For the past nine years Great Britain has practically held this trade, though during and after the war period the United States secured a good foothold. American motorcycles are from 30 to 35 percent cheaper than the English product, though the weight and style of the English machine suits the demands of the Indian market.

That the American automobile stands in high esteem in Argentina is seen from the following editorial which appeared in a recent edition of El Hogar, one of the most popular of Argentina's weekly magazines: "Automobiles have been reduced in price in the United States and are now selling at very close to pre-war prices. Most certainly this notice of the reduction in price has gladdened us, for if there is in the world a city which needs automobiles, that city is Buenos Aires. The automobile is the only means by which we can hope to solve the problem of traffic in the narrow and congested streets of the center. It is strange that the wholesale houses and important establishments have not yet adopted the truck and auto delivery wagon."

The Philippine Islands are soon to have a postal aerial service. Regular lines will be maintained from Manila to Cebu and from Manila to Zamboanga. Five hydroplanes have just been received from the United States. The airplanes will be operated by Philippine aviators trained by the Philippine National Guard.

Several motor buses have been installed on the principal avenues of Guayaquil to carry passengers to and from the Salado from 9 to 11 o'clock each morning. Three hundred and thirty-seven motor cars were registered in Guayaquil on April 7, 1921.

Motor Vehicles in Japan

During 1920, 1,745 automobiles, valued at $2,425,518, and automobile parts to the value of $2,798,141 were imported into Japan. The total value of automobiles imported in 1919 was $2,757,473, and the value of automobile parts was $2,866,754. The number of automobiles imported in 1919 was 1,579, which indicates that a larger number of medium and low priced cars were imported in 1920 than in 1919.

The value of automobiles and parts imported from the United States was $5,405,818 in 1919 and $5,015,130 in 1920. Italy exported automobiles to Japan amounting in value to $138,041 in 1919 and $9,889 in 1920. No other country had an important share in the Japanese automobile imports in these years.

Methods of Importation

In recent years the value of the automobile parts imported into Japan has exceeded the value of the automobiles imported, the excess being relatively much greater in 1920 than it was in 1919. This is explained by the fact that approximately 60 percent of the motor vehicles imported into Japan are brought here as unassembled parts of cars and not as complete automobiles, a practice which is the result of a discrimination in the tariff in favor of automobile parts, together with the saving in freight charges that can be made by the closer packing. As a rule the chassis and other smaller parts are imported without the body, which is built in Japan.

Building Automobile Bodies in Japan

As a result of the discrimination in the tariff laws of Japan against complete automobiles, there has developed a considerable industry in the manufacture of automobile bodies. Almost every dealer in automobiles in Tokyo, where this industry has shown the most rapid development, has facilities for building automobile bodies to order, and it is estimated that from 150 to 250 automobile bodies can be manufactured in Tokyo each month. Many purchasers prefer to have the bodies for their automobiles built in Japan, because it is possible to manufacture here a body that will accommodate seven Japanese persons, besides the driver, and mount it upon the chassis of a small car, thus effecting a considerable economy in both cost and upkeep. Such a body could not contain seven average Americans, but the small stature of the average Japanese makes the arrangement possible.

Automobile bodies constructed in Japan are usually made of wood. A small percentage of them are built of sheet metal, but as there are no dies for pressing sheet-metal bodies they are made by hand, and the scarcity of skilled sheet-metal workers and the higher wages paid them limits the construction of this type of body.

Types of Automobiles Preferred—Small Cars Popular

It has been estimated that there are no more than 9,000 automobiles in Japan, of which about 70 percent are of American manufacture.

There can be no doubt of the popularity of the small car in Japan. Its initial cost is more nearly within reach of the average income and its upkeep is less expensive. Furthermore, a small car can be handled with greater ease and speed on the narrow roads and city streets than can a car with a long wheelbase and heavy body. The high price of gasoline and motor oil, and the heavy prefectural and municipal taxes on high-powered cars are also contributing factors toward the desire for low-priced machines.

The outlook for the sale of automobiles in Japan during the present year is generally considered unfavorable. The business always reflects the condition of trade in other lines and the present business depression shows little sign of improvement in the near future. There are on the docks in Yokohama a large number of automobiles, imported last year, which have not been claimed by their importers because of financial circumstances, and many importing firms have large stocks of machines which they have held over from last year due to lack of demand.

Suggestions for American Manufacturers

An American automobile dealer of considerable experience in Japan suggests the following precautions, which it would be well for American automobile manufacturers to observe in preparing their products for this market.

Care should be taken in packing automobiles intended for export to this country. Too frequently they arrive in a damaged condition as a result of poor or insufficient packing. The dissatisfaction which this causes the importer is not helpful to American trade.

All steel parts of automobiles, as well as of other machinery, should be well greased before packing for shipment to Japan. This should include the interiors of the cylinders of motors. It is a common occurrence for a shipment of imported goods to remain upon the wharves in the customs compound in Yokohama for six weeks or more after being unloaded from the ship on which it arrived, because of delay in getting the goods passed through the customs. During this time the goods are often fully exposed to the weather, and this is particularly likely to happen if they are packed in large cases. The salt, humid air of the water front causes exposed iron or steel to rust very rapidly unless it is well protected by a thick coating of grease.

The fenders of automobiles intended for the Japanese trade should be given an exceptionally heavy coating of paint to keep them from rusting when used in cities and towns along the Japanese coast, where the air seems to be particularly destructive to them and gives the average fender a rusty appearance in a comparatively short time.

A list of Japanese importers of and dealers in motor vehicles may be obtained from the Bureau of Foreign and Domestic Commerce or its district and cooperative offices by referring to file No. FE-11003-A.

The Rumanian press reports that the production of crude petroleum in Rumania for January and February, 1921, was 82,977 tons divided by districts as follows: Prahova, 62,502 tons; Dambovitza, 11,971 tons; Buzau, 5,752 tons; Bacau, 2,752 tons. The newspaper Roumanie maintains that the high export taxes have paralyzed the export in this branch of industry, and that the markets in central Europe, formerly held by Rumania, are being filled with Polish oil, the prices being helped by the depreciation of the Polish mark.

The Polish government now permits passenger automobiles to be admitted beginning April 13, upon payment of a customs duty of 13,500 Polish marks per 100 kilos of weight. The importation of motor trucks has always been permitted, but after April 13 the duty on these will be 300 Polish marks per 100 kilos.

What is the Real Mexican Oil Situation

Recent Statements of Impending Exhaustion of Mexican Oil Fields Have Startled the Automotive Industry, Largely Dependent on It

WHERE will the fuel for the motor cars of the future come from is a question which has been brought up many times since the annual motor vehicle production reached and passed the million-a-year mark. Until quite recently, the general answer has been, from Mexico, which was considered to be largely a virgin field, despite the twenty to thirty million barrels of oil annually produced. In recent years, spurred on perhaps by the high prices being paid for oil, the Mexican producers have outdone themselves and have increased their output by much greater amounts each year than any other field ever has. Consequently the twenty million barrels of a few years ago has doubled, and redoubled, and doubled again, and last year's figure approximated 160,000,000 barrels.

Mexican producers and the general public thought and expected that this rate of increase could go right on indefinitely, and that as such it would take care of the tremendous increase in the number of motor vehicles in use, no matter how great the latter might become. Now that the output of cars and trucks approximates two million a year, against which number eliminated or retired from service is slightly less than a million, so the total number in use gains about a million and a quarter a year, the future source of an adequate supply has become so important as to concern the car manufacturers, previously quite indifferent to fuel supply or quality.

Just recently a number of the larger and more important Mexican producing wells have either ceased to produce or have gone into salt water so that the production was useless. The coincidence of a number of the more prominent producing wells doing this at about the same time attracted much attention, brought about several investigations, and one of the latter resulted in a report that the present Mexican oil fields were practically exhausted, and would be wholly exhausted or would have gone into salt water within a very short time.

This is generally spoken of as the Phelan report. It was submitted to the Shipping Board by U. A. Phelan, who stated that in the 40 square miles of producing territory in Mexico, 63 out of the total of 104 oil wells had ceased to produce and that salt water was rapidly filling many of the others. He stated also that not a single new oil structure had been discovered in Mexico since 1916. He stated also that the Tampico-Tuxpam field which has been estimated to contain 4,500,000,000 barrels as a maximum, is going into salt water most rapidly.

Up to and including 1920, there has been taken from all Mexican oil fields a total of 532,000,000 barrels. It may fairly be considered that 85 percent of this or in round figures 450,000,000 barrels have come from the Tampico-Tuxpam field. On this basis there would be but 4,050,000,000 barrels left, and this would be but 2½ years' production at the 1920 rate.

Inasmuch as all the other fields are small, and their outputs relatively unimportant, this report hinted at or practically predicted the exhaustion of the Mexican fields as a source of oil within two years.

The United States and Mexico made up 84 percent of the world's production in 1920, and the United States produces about 95 percent of the world's motor vehicles, so the automotive manufacturers may well be concerned as to the truth of such statements, and the actual situation. Should the statements which Mr. Phelan made be correct, and should present conditions continue, the following table will show about what may be expected to work out:

	1920	1921	1922	1923	1924	1925
Vehicles in use.....	9,211.000	10,600,000	12,100,000	13,700,000	15,400,000	17,100,000
Oil production, bbls.....	443,402,000	500,000,000	550,000,000	590,000,000	625,000,000	655,000,000
Gasoline production, gals...	4,482,546,699	5,500,000,000	6,050,000,000	6,490,000,000	6,875,000,000	7,210,000,000
Gasoline consumption	4,256,428,000	4,903,000,000	5,600,000,000	6,340,000,000	7,123,000,000	7,910,000,000
Surplus gasoline	628,118,699	597,000,000	450,000,000	150,000,000	*248,000,000	*700,000,000

*Shortage.

To explain, this table is based on the assumption that the rate of production of cars has about reached a steady level, as has also the rate of elimination of old cars. The totals in use are obtained by estimating the production and deducting the number eliminated in each year, the latter being based rather closely on the production for the sixth year previous at the outset and subsequently on the seventh year previous. It is assumed that the great increase in United States crude oil production from 1919 to 1920, or nearly 66,000,000 bbls. would not be continued, and in fact would decrease continuously. That is an increase if figured in, but a gradually reducing one. Present oil production and gasoline production figures indicate an extraction of 11 gallons of gasoline per barrel of crude. Although seemingly very low this has been continued. Present number of cars in use and rate of consumption indicate 462 gallons of fuel per vehicle per year, and this figure is continued, although with the gradual replacement of the older and more wasteful cars and trucks, this figure should be reduced. On the other hand greater use of the vehicles might increase it.

What the table shows is that we would continue piling up a surplus through 1923, but in 1924 consumption would exceed production to such an extent as to cut down the surplus. Carrying the figures forward shows this tendency very much exaggerated in later years, so much so that the surplus would be entirely wiped out in 1926, and rationing would be necessary in that year.

This is on the assumption previously made that the Mexican fields would not be in a position to help out the failing production in the United States, so that this country would have to depend wholly upon itself and its own oil fields. Just at this time, this question has a double importance because prospecting for new oil fields in this country has temporarily ceased and no new work of any kind is being done except in Alaska, while the number of well completions has dropped very low in recent months, practically all drilling having ceased. All over the country, both large and small producers have stopped drilling and laid off their drilling crews. In the first six months of 1921, according to the Oil City Derrick, an authority on the subject, completions in the oil fields were 12,611, which is a decrease of 2,787 over the same period of 1920. While this is a decrease of but 18.1 percent, the figures when closely examined have a deeper significance. The number of dry wells in 1920 was 3,175, and gas wells 980, so that the net number of producing new wells was 11,243. The production from these was 1,872,611 bbls., making the average from each well 166½ bbls. As this is for the half year, the year's total would be 333 bbls., and the total added by the new production 3,745,222 bbls. The 1921 figures show 2,971 dry and 1,072 gas wells, so the net number of producers was 8,568. Their production was 1,328,637 bbls. or an average of but 155 bbls. for the half year and at the rate of 310 bbls. for the year, with a total indicated production for the new wells in the full year of 2,657,274 bbls.

Thus, the figures indicate a reduction in the amount of new production of almost a million barrels for the year, close to three thousand in the number of producers, and a marked reduction in the average production, indicating that the quality of the fields in which drilling has been proceeding is much lower than in previous years.

In addition, many refineries have shut down, so that it may fairly be predicted that the 1921 total production may not be as large as 1920 was. In the table above, outlining the general situation, by way of outlining our partial dependence on Mexican sources of supplies, it will be remembered that an increase for 1921 of fifty-five and a half million barrels was figured in, basing this on the sixty-five and two-thirds million increase of 1920 over 1919. Hence this recent tendency makes the situation even more serious.

Returning to the Mexican fields, E. L. Doheny, president of the Mexican Petroleum Co., the largest of the Mexican producers, outside of the Dutch Shell and Standard Oil groups, and himself probably the best posted man on the Mexican oil situation, the Phelan report was made as a result of a single, short trip through the country, and the cursory examinations incident thereto. He went on to declare that since the Phelan trip to Mexico 145 wells have been completed, and some of these have opened up entirely new territory, which of itslf is more than three times as large as the area of all producing fields as mentioned in the Phelan report. That is, of 120 square miles, which can be added to the 40 Phelan mentioned to make a total of 160 square miles of proven oil fields. Mr. Doheny quoted George Otis Smith, director of the U. S. Geological Survey, to the effect that the total proved oil area of Mexico is 10,000 square miles, and the total oil reserves of the discovered fields are stated in the Stebinger-White estimates at 4,500,000,000 bbls. (about May, 1921).

This is very different from the previous statements and would give the Mexican fields a life of 28 years at the 1920 rate.

Mr. Doheny stated further that Mr. Smith had estimated the life of the Mexican proven oil fields of today at one generation. A generation is usually taken at 33 years, which agrees roughly with the other figure just given. If it be considered that the Pennsylvania oil fields, or rather what is now spoken of as the Appalachian region, started to produce in 1869 and continued as the world's leading producing region up to 1899, which is a total of 30 years, and that this field is still producing in large quantities (about 7 percent of this country's output, and of itself larger than all the other fields of the world, except Mexico and Russia), 22 years later. If we give this notable field a further life of 7 to 10 years, either figure—that for the heydays, of that since reaching the peak—check well with the previously-given Mexican oil field life figures.

To refute Mr. Phelan's statement about Mexican wells ceasing to produce or going into salt water, Mr. Doheny states that this hangs entirely on the words "reasonable period," and admits that in the course of time, the Mexican wells do this. But he cites the fact that the well-known Casiano and Petrero del Llano wells each produced 80,000,000 bbls. of oil before going into salt water or ceasing to produce. Mr. Doheny rightly states that when a well has achieved a production such as this, reasonable expectations can go no further, and no one could complain if such a well did go into salt water or stop producing.

Another authority on Mexican oil fields gives these estimates of the various existing pools: Zacamixtle, 125,000,000 bbls.; Cerro Azul, 75,000,000 bbls.; Los Naranjos, 50,000,000 bbls.; Panuco, 50,000,000 bbls.; Alamo, 25,000,000 bbls., or a total of 325,000,000 bbls. But previously he has stated that Los Naranjos is producing at the rate of 95,000,000 bbls. a year and may continue to do so, so that the figure for that field probably should include a one in front of the figures given, thus raising the total of this estimator to 425,000,000. This estimate, too, takes no account of the smaller fields, nor of the possibilities existing in the southern portion of Mexico, that is in the part of the country adjoining the gulf coast between Tampico and Yucatan, under all of which it is admitted there is some oil.

Recent exploitation in the districts of Lacalulu and Cobus have brought important results. The former is an oil bearing formation situation in the extreme southeastern corner of the State of San Luis Potosi, about 50 miles southwest of Tampico, and in a north and south direction about midway between Tampico and Tuxpam. This field is cut in two by the Juan River, which flows into the Panuco. A well was recently opened in this district which is yielding from 40,000 to 60,000 bbls. daily, or at a yearly rate of about 18,000,000 bbls. a year. This for one well alone predicates a fairly large output from this field when further developed, sufficient at least to warrant giving it major attention.

The Cobus district begins at Cobus, which is directly across the Rio Gonzales from Tuxpam, and from there extends southwesterly about 50 miles, which would include practically all of the northeastern corner of the State of Puebla, not previously considered as oil territory. This is now regarded by experts as a determined

oil field, and there is definite exploitation going on (July 15).

Exploration work is being carried on in all parts of Mexico, including lower California. So far nothing definite has resulted, partly perhaps because of poor transportation, or none at all, which has its influence upon work of this kind. There are sufficient prospects in the southern part of the State of Oaxaca to warrant the sinking of a well, which necessitates the investment of $100,000. Exploration is particularly active on the Isthmus of Tehuantepec and in the region immediately south of Vera Cruz. The isthmus includes the southeastern part of the State of Vera Cruz, the eastern part of the State of Oaxaca, and the western parts of Tabasco and Chiapas. The Tabasco district is the oldest oil field in Mexico and the refinery at Minatitlan, near Puerto Mexico, at the northern part of the isthmus, is the largest in Mexico. Much oil is taken from the Tampico fields south to this refinery, but little oil is now produced in the Tabasco district and the future prospects for this old oil producing section are based on the new developments on the isthmus.

According to the Financial and Mining Bulletin of Mexico, there were 359 producing wells in the country on Jan. 1. These registered a daily production of 3,117,896 bbls. From Jan. 1 to May 1 there was an increase of 42 wells with a daily output of 828,728 bbls. In the Amatlan district of the Tampico-Tuxpam fields three or four wells recently were opened with an aggregate yield of 377,000 bbls. daily.

Combining these figures it would appear that there are totals of 405 (or more) wells flowing and having a daily output of 4,323,624 bbls. (or more). This gives the Mexican wells an average output of 10,600 bbls. per well per day, and the country a total yearly output, with all wells flowing at capacity, of 1,578,000,000 bbls. That is to say the total capacity output of the known and proven wells is almost ten times the actual marketed output.

These facts, taken with the general average of all reliable estimates of the life of the fields, that is about 30 years, would seem to dispose of the contentions put forward recently, and to brand them, as Mr. Doheny and others unhesitatingly did, as propaganda. At any rate, it would appear from the figures presented that American automotive manufacturers can count upon such assistance as Mexico has given in recent years, in the way of raw materials for fuel and lubricants, to continue unabated for many, many years, possibly as long as our own oil fields. By that time, it is hoped that the huge western oil shale fields will have been developed to the point where they will be furnishing sufficient fuel and lubricant to replace both the present United States and Mexican oil fields.

Tire Makers to Meet Quarterly

Tire manufacturers numbered in the membership of the Rubber Association of America have responded to a request from the office of A. L. Viles, general manager, with indications that a large number of them favor meetings of the whole tire manufacturers' division to be held quarterly; and in addition to the present monthly meeting of the executive committee of that group. As yet, however, plans for these meetings are incomplete, and it is expected that the first one will be held not sooner than September.

Lawrence Phillips Now Secretary of Valentine & Company

Lawrence Phillips has been elected secretary of Valentine & Company, New York. Mr. Phillips is a graduate of Princeton University, '1 . En.is.ing in the 27th Division, he spent some months at Spartanburg, S. C., becoming in due course a sergeant and first lieutenant. On going overseas he served on the general staff at general headquarters. He was a representative of the United States at an inter-allied conference at Versailles in '18 for which he prepared the data used by the United States.

After leaving the army Mr. Phillips spent two years with the Remington Typewriter Co., becoming manager in charge of production schedules and sal.s of the Yost machine, which machine is sold exclusively abroad, and finally a manager of the Remington far eastern sales department.

Mr. Phillips' further activities include banking and economic research, from which last connection he resigned to become identified with Valentine & Co. It is interesting to note that the firm of Valentine & Co., the predecessor of the present corporation, held the first agency for the sale of Remington typewriters throughout Europe from 1880 to 1882, the business being handled by their Paris branch. Lawrence Phillips is the son of A. Lawrence Phillips, who has been identified with Valentine & Co. for many years as secretary and treasurer. Mr. Phillips, Jr., will relieve his father of his duties as secretary and will act as his immediate assistant.

Increased Imports of Motor Cars Into Hankow

In 1920 there were 47 motor cars valued at $67,202 imported into Hankow, China, which is 20 cars in excess of the imports for 1919. The continued development of the motor car industry in Hankow is dependent upon the construction of a greater mileage of highways. In 1912 there were but three cars—two French and one British —while at the present time there are 172, of which 140 are American. All these cars are licensed passenger cars, except five motor trucks, two of which belong to the Chinese postoffice. There seems to be a steady increase in the number of motor cars operated in Hankow, notwithstanding the fact that there is not an excess of 25 miles of suitable roadway, including cross streets, 20 miles of which are located within the foreign concession. On account of this restricted operating area, motor cars in Hankow are more of a luxury than a necessity. American cars are popular, but it must be borne in mind that world conditions have hitherto given American manufacturers the market with little competition.

Death of Frank Schanz

Frank Schanz, 405 Randolph street, Philadelphia, who had conducted a wagon and motor truck body business at the above address for many years, died in a Philadelphia hospital on June 10th, following a prolonged illness. Mr. Schanz was one of the best-known men in the Philadelphia body trade, and was treasurer of the local vehicle body builders' association for a long time. He resigned from this position recently, much to the regret of the members, and was succeeded by August Geissel. He served with credit as a member of Philadelphia city council and was among the leaders in local political activities.

Cost of Farm Tractor Operation Low

Official Government Figures Indicate Replacement of 2.1 Horses Per Tractor, With Incidental Savings in Labor, Time and Other Items

TRACTORS offer a splendid field for the automotive vehicle manufacturer to take up as a closely allied side line, that is the manufacture of cars and tractors, or trucks and tractors, or motor boats and tractors, or engines and tractors, or other combinations of automotive vehicles or parts with tractors. Such a combination offers possibilities in two ways, the saving in making the similar parts so that very large quantities are going through the plant continuously with resultant low unit costs, and the sales advantage of a product with a different season, which fits in with rather than clashes with the other selling season.

Thus, the farmer buys his tractors through the winter, in the early spring, and to a small extent in the early fall. Automobiles on the other hand do not start to sell in large quantities until late in the spring, continue steadily into August, then taper down, and after the late fall sales of closed cars are quite negligible. Thus, figures are available for tire sales, which parallel car sales quite closely, following slightly behind perhaps inasmuch as renewals would come only after use. The distribution of tire sales through the year is as follows:

January	4	August	12
February	5	September	10
March	5	October	5
April	9	November	4
May	13	December	4
June	15		
July	14		100

It would seem that a fair distribution of the car sales could be obtained by using similar figures for each preceding month, that is the figures above moved forward one month, with a modest addition in September to represent closed car sales.

Referring back to tractors, the heavy sales would come in the months when automobile sales are small, that is such months as October, November, December, January, February and March would be the heavy ones, while the middle of the year months would represent small tractor sales. Consequently the two together would bring about a nice even profitable sales curve.

All this simply emphasizes the fact that the manufacturer of an automotive vehicle should be constantly on the lookout for facts and figures, especially cost figures relating to other automotive vehicles or units which would fit into his business in such a way as to level out the peaks and valleys of his sales curve.

With this thought prominent, some cost of operation data are here presented. These were gathered by representatives of the U. S. Department of Agriculture in October and November, 1920. These representatives visited 286 tractor owners in Illinois, Indiana and Ohio, and from these farmers obtained a complete record of all the work done during the year with horses and tractors.

As a summation, the department estimates that it costs about $2.90 an acre to plow with horses, and about $2 by tractor; disking 67 cents an acre by tractor, 64 cents by horse; cutting grain, 67 cents by tractor, horses 59 cents. This is a saving of 31 percent for the tractor in one case, and of 13.5 and 4.7 percent for the horse in the others.

The average size of the farms visited was 258 acres. This is considerably above the average size of all farms in these states. The following tractor equipment was found on the farms:

2-plow tractors on 174 farms.
3-plow tractors on 104 farms.
4-plow tractors on 6 farms.
1-plow tractor on 1 farm.
5-plow tractor on 1 farm.

Two-plow machines were found on 75 percent of the farms with less than 160 crop acres, and on 53 percent of those with 160 or more crop acres.

One hundred and six of the tractors had been in use 1 year, 100 had been in use 1½ or 2 years, 49 had been in use 2½ or 3 years, and 31 had been in use more than 3 years.

On the average the tractors were used for 30.8 full days during the year covered by the investigation. Twenty-three and five-tenths days of this was drawbar work on the home farm, 2.7 days was belt work, and 4.6 days was custom work. Seventy-three of the 286 tractors did less than 20 days' work during the year and 26 did 50 or more days' work.

The number of workstock still owned varied from 2 head on 11 of the farms to more than 15 on 5 of the large farms. On the average there were 6.8 head per farm at the time of the survey, and their value was $145 per head. In all there were 1,878 head of workstock on the 286 farms and 111 colts less than 1 year of age.

Farm Horse Works One Day in Five

The average number of full days work per year per horse, for all farms was 68.6. On 20 of the farms the workstock did less than 40 full days' work and on 27 they did 100 or more days' work per year.

The tractors did 85 percent of the plowing on these farms, 73 percent of the disking, 43 percent of the harrowing, planking, rolling and packing, 41 percent of the grain cutting and about 15 percent of the loading and hauling of hay.

Of 267 men who did spring plowing, 142 did it all with tractors, 121 used both tractors and horses and 4 used horses only.

Of 225 who did fall plowing, 190 did it all with tractors, 27 used both tractors and horses and 8 used horses only.

Of 284 men who did disking, all but 15 used tractors for at least a part of it. One hundred and thirty men used their tractors for cutting grain and 37 for drawing the hay loader. A smaller number used their tractors for any other drawbar operation.

In all, the power for 30 percent of the drawbar work on these farms, as measured by days of horse labor required for it, was furnished by tractors and the remainder by horses.

The average cost per head of keeping workstock on

these farms for the year ending Nov. 1, 1920, was $159, and the average cost per farm was $1,076.

This cost includes charges for feed, at the average price for the year, chores at 25 cents per hour, shoeing, veterinary, harness, interest at 6 percent and depreciation. A manure credit of $15 per head was allowed.

Feed and Depreciation

Exclusive of grass and stalk pasture, the average ration per horse consisted of 1.3 tons of hay, 1.2 tons of straw, .2 acre of stover, 37.8 bushels of corn and 22.3 bushels of oats. The total cost of feed per head was $134. Based on present prices (March, 1921) the cost of feed per head would be about $80.

The average cost per day of horse labor for the year of the survey was $2.43. Based on present prices the cost on these farms would be not far from $1.50 per day.

The average first cost of the 2-plow tractors was $972, of the 3-plow tractors $1,354, and of all tractors $1,140. The average amount spent for equipment, mostly plows and disks, for use with tractors was about $340. The average value of the horse-drawn implements disposed of after the purchase of the tractors was $12.

The average life of these tractors, as estimated by their owners, is 6.7 years. The annual depreciation of the 2-plow tractors amounted to $164, and of the 3-plow, $217. The annual cost of repairs, including the value of the owner's time spent in repairing the tractors, was $39 for both the 2-plow and 3-plow sizes. The tractors had been out of commission when needed, an average of about 2 days during the year. A little over 50 percent had not been out of commission at all when needed, and about one in seven had been out of commission five days or more.

The fuel consumption per day for the 2-plow tractors varied from about 18 gallons for fall plowing to about 11 gallons for drawing the hay loader. For the 3-plow tractors it varied from 23 gallons for plowing to 15 gallons for drawing the hay loader. The 2-plow tractors covered 6.6 acres per day in plowing and the 3-plow machines, 8.6 acres. The amount of fuel required per acre by the two sizes was practically the same, 2.8 gallons for the 2-plow and 2.7 gallons for the 3-plow tractors.

Little Difference in Plowing Costs

The average cost per acre of power for the plowing done with 2-plow tractors was about $2 and with the 3-plow about $2.20. The cost of power for the plowing done with horses on these farms was about $2.90 per acre. Based on the present costs of keeping workstock, the cost of power for plowing with horses would be about $1.90 per acre. For most of the other operations the cost of power when furnished by horses was slightly less than when furnished by tractors. The cost per acre of power for disking with tractors was 67c; with horses, 64c; for cutting grain with tractors, 67c; with horses, 59c. These figures represent the cost of power only and do not include either the cost of man labor, or that of the implements used.

The average cost per day of 2-plow tractors for drawbar work on the home farm was about $12.65 and of 3-plow tractors about $17.75.

The total cost of power furnished by the tractors for drawbar work at home during the year averaged $341. This drawbar work on the home farm constituted 76 percent of the total work done by the tractors, and only 76 per cent of the total annual charge for depreciation, repairs and interest on investment, is included in it. No charges for taxes, insurance or shelter are included in the costs for either the tractors or workstock.

Nine of these men had started farming with tractors and the remainder had increased the size of their farms by an average of about 20 acres since the tractors were purchased. There had been no change in size of 172 of the farms, 81 had been increased in size and 24 had been decreased. It is probable, however, that in most cases the tractor was not primarily responsible for the change in size of the farm.

Keeping the Horses

On the 172 farms where there had been no change in acreage the number of workstock had been reduced by 2.2 head, an average reduction of 26 percent. Forty-four of these 172 men had not reduced the number of workstock, 62 had disposed of 1 or 2 head, 43 had disposed of 3 or 4 head and 23 of more than 4 head. On these 172 farms one horse had been kept for each 28 acres (total acres, not crop acres) before purchase of tractors, and at the time of the survey there was one horse for each 37.7 acres. For all the farms there had been an average of one horse for each 27.6 acres before purchase of tractors, and there was one for each 37.9 acres at the time of the investigation.

On the farms where there had been no change in acreage there had been one horse for each 21.5 crop acres before the purchase of tractors, and there was one for each 29 crop acres at the time of the investigations.

With the tractors doing the bulk of the work of plowing and fitting the ground, the cultivation of corn is the operaion which requires the greatest amount of horse labor in the shortest time on most of these farms. However, on only 105 of the 286 farms were all the workstock used for cultivation, and on only 38 of the remainder were they all used for any other one operation. On just half of the farms all the workstock were not used for any one operation.

There were great variations on individual farms in the cost of power furnished by both horses and tractors; and by more careful management many farmers could doubtless reduce this cost. Repair costs and fuel consumption of the tractors could in many cases have been reduced by more careful operation. The cost of keeping workstock could have been reduced on many farms by more careful feeding practices. The facts that on 20 of the farms the workstock did less than 40 days of work per head during the year, and that on half of the farms they were not all used for any single operation, indicate that on some farms there are still more workstock than needed for the system of farming being practiced.

Comparative Cost

The average annual cost of power for the drawbar work on the home farm which was done with tractors was equal to the cost of keeping 2.1 head of workstock and this is practically the average number displaced per farm. On the basis of present prices, however, the cost of keeping workstock has declined considerably more than the cost of operating tractors.

This information, it would seem, furnishes the vehicle manufacturer considering future manufacturing possibilities with some desirable data having a close bearing on sales. Additional data will be found in the September, 1920, issue, page 19, January, 1921, issue, page 32, and May, 1921, issue, page 22.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO.

Heptagon Building, 153 Waverly Place, New York City

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXIII July, 1921 No. 4

City Horses Being Replaced Rapidly

SOME interesting figures have been published recently by the U. S. Census Bureau relative to horses, and they appear to show quite plainly that the number of draft animals in our larger cities has decreased to a remarkable extent. According to these official figures, New York in 1910 had 128,224 horses in use while in 1920 it had but 56,539. This is a decrease of 71,685 in the 10 years or an average per year of 7,169. At this latter rate, New York will be horseless in 1928.

However, other figures are available on this subject and they tell quite a different tale. The Sanitary Bureau, Health Department, City of New York, published the results of its own census of stables and horses in the summer of 1920 (see Automotive Manufacturer, August, 1920, page 11), and these figures give the totals for 1917 and 1919. Using these in combination with the government figures it is possible to figure out the fact that the decrease from 1910 to 1917 was at the rate of less than 3,000 horses per year, from 1917 to 1919 at the rate of more than 16,000 per year, and for the following year at the rate of more than 19,00, 19,201 to be exact. Taking this latest figure, it would seem that our largest city will be horseless within three years, but if the acceleration of recent years continues, it will be nearly horseless by the end of two years. Actually, it will be nothing of the kind, for there will always be those within the greater city who will continue to use horses as draft animals, but it is interesting to note these trends.

The figures for other large cities show a similar tendency. Thus, for the years 1910 and 1920, Philadelphia had 50,461 and 19,472; Chicago had 68,122 and 30,088; Boston had 23,007 and 10 093; Cleveland had 16,839 and 4,924; Baltimore had 15,346 and 7,378; Cincinnati had 13,901 and 5,031, and Pittsburgh had 12,845 and 6,032.

Lacking intermediate years, these figures show that based on the 10-year average decrease, these cities will have no horses in the following number of years: Cleveland, 4 years; Cincinnati, less than 6 years; Philadelphia, 6 years; Boston, less than 8 years; Chicago, 8 years; Pittsburgh, less than 9 years, and Baltimore, 9 years. If these seven, with New York, be averaged it appears that our large cities will be practically without horses in an average of 7 years.

As a mater of fact the census and department of agriculture figures show a decrease for 1921 and also for the 10-year period 1911-1921 on farms, that is beginning to show the effect of the large number of tractors put into use in recent years. The year 1920 showed an increase but 1921 shows a decrease of 94,000 horses. Mules are generally classed with horses as farm draft animals but they show an increase of only 676,000, so the gain for the two when combined is but 582,000. In the combined totals, this amounts to but a little over 2 percent, and just barely brings the grand total above 25 million animals. This is the third year in succession that horses have shown a decrease and the first year the number of mules has ever shown a decrease.

The Lampert Bill and Patent Office Salaries

THOSE who are interested in the Patent Office and its proper management, as well as in patents and inventions in general, will be interested to follow the Lampert bill through the present Congress. This bill provides adequate salaries to the present force of examiners, and an adequate staff which will permit the office to catch up with the 50,000 (nearly, 46,472) to be exact) cases which the office is behind its schedule. The single fact that the Patent Office examiners have had but one increase in salary since 1848, and that one only 10 percent, is reason enough in itself. When it is considered, further, that the passage of this bill and its application to Patent Office affairs will add but $1,951,840 to the yearly budget, while the office annually turns more than this amount over to the Treasury as its profit, so that in reality there would be no increase at all, there does not seem to be a single adequate reason that can be advanced by anyone against this measure.

To Revise Rubber Buying Practice

Buyers and sellers of crude rubber in New York are about to get together in a study of rules and practices governing the trade, and to bring them more nearly in accord with each other and with prevailing conditions. Ths step is being taken at the instance of the crude rubber committee of the Rubber Association of America, which is to be represented on a joint committee with the Rubber Trade Association of New York, an organization of rubber importers, brokers and dealers. This committee will study existing rules as laid down in the "Rules and Regulations Governing Transactions Between Buyers and Sellers of Crude Rubber, of the Rubber Association," and the "Rules and Regulations of the Rubber Trade Association." It will endeavor to harmonize the two sets of rules, and will submit recommendations to the respective associations.

It has been decided to inaugurate an aerial service between Peking and Shanghai beginning June 1, 1921, with a passenger fare of $200 Chinese currency for single tickets and a postage of 18 cents for each letter.

Special Heat-Treating Furnaces for Molybdenum Steel Parts

Unusual Automatic Furnaces Installed in Wills-St. Claire Plant at Marysville, Mich., to Insure Correct Heat Treatment of Many Molybdenum Steel Parts Used

PROGRESS in automotive construction in recent years has been along the line of superior performance and lighter weight. The former has been notable for all cars, large or small, and in itself constitutes the real reason why there are ten million cars and trucks in use in the world today. The latter, on the other hand, has come up but recently and has been more noticeable in the lower and medium priced cars. The reason for this is not hard to find, the call for lighter weight in a car is really a disguised call for economy of operation, inasmuch as lighter weight means smaller tires and other parts reducing the first cost, longer life for these tires and consequently lowered tire costs in operation, lessened oil and gas consumption and consequently greatly decreased cost of operation.

Greatly reduced weight can only be obtained through the use of superior alloy steels or other light weight metals such as aluminum, the magnesium alloys, etc. These cost a great deal of money, so that until the consumption of the extra light weight metals has attained a very large tonnage, as for instance in the case of vanadium alloys by Ford, this extra cost of the light weight has been and still is almost prohibitive, except possibly for a few outstanding pieces which can be used for talking points.

In the case of the new Wills-St. Claire car the result of large tonnage consumption has been brought about by its use throughout the car, that is not for three or four pieces, but for hundreds, literally for the entire car. The net result has been to produce a very high grade machine, so that the five-passenger touring car with its 121-inch wheelbase weighs but 3,100 pounds, low enough to warrant the use of 32x4½-inch tires. It has made some new records for power and economy as well as other desirable qualities.

All these qualities, as well as the summation of them, are attributed to the molybdenum steel used, and this has been made possible through the very unusual heat treating outfit installed at the new Marysville plant of the Wills company. This installation, which is practically automatic in operation, has been installed with due appreciation of the fact that the characteristic properties of molybdenum steel could be brought out only through proper heat treatment. In addition, it was considered that individual, hand operation in the heat treating would not be possible with such a large number of parts, nor would it be sufficiently accurate, nor if accurate, consistently so. It was felt that the only way in which the desired results could be attained and continuously produced, was by the use of automatic apparatus, which could be set and started, after which it would continue to function regularly and accurately along the exact lines of the original setting. Consequently, as will be described on the following pages, the apparatus is automatic in action.

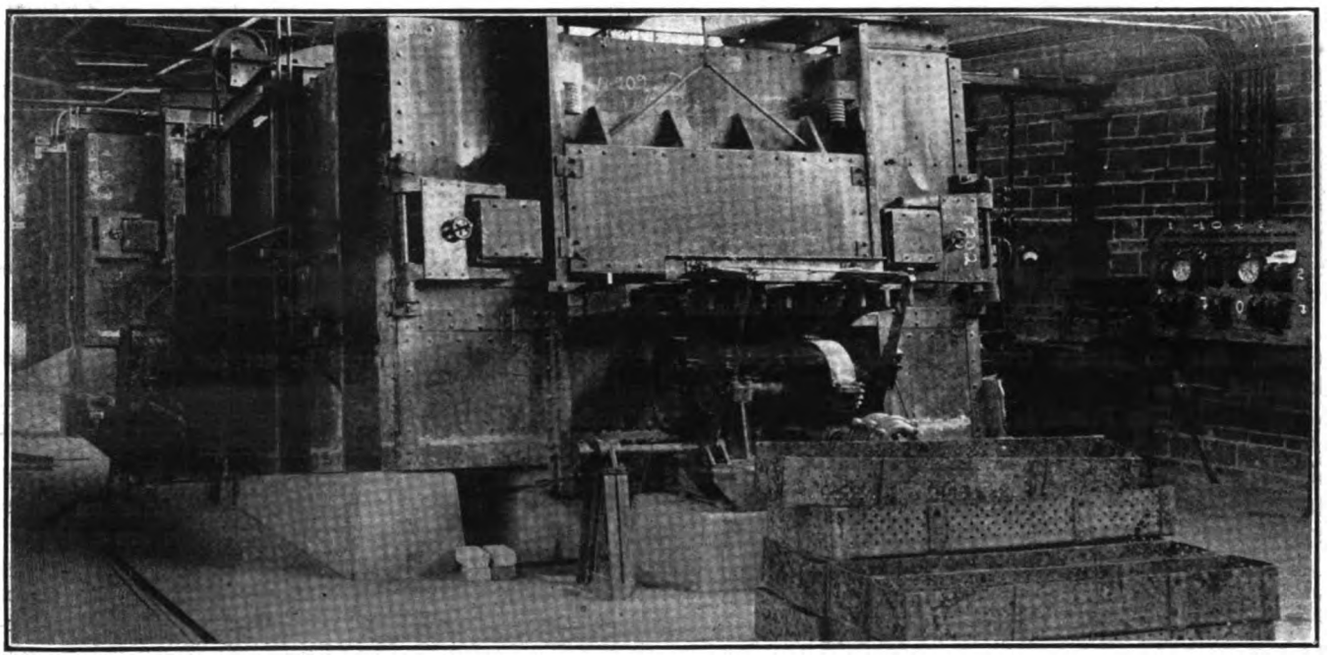


Fig 1. Front end of hardening furnace at Wills plant showing charging platform and pusher.

The heat treating equipment of the C. H. Wills Company was built by the Electrical Furnace Company, Alliance, Ohio. It consists of a set of two similar electric furnaces, each with a hearth substantially 5 feet wide and 15 feet long, having an electrical capacity of 400 k.w. for the combined unit, and a heat treating capacity of 1,500 pounds per hour. As the material to be treated consists of a large number of parts of different size, ranging from the axles and crank shafts to

the smallest parts entering into the construction of the car, it was necessary in order to get the most convenient operation to place all the material in pans or containers. The parts remain in these pans through the hardening and quenching operations and through the drawing operation as well. Electric motors, actuated by a time clock mechanism, raise and lower the furnace doors, advance the material through furnaces and quench, and make it unnecessary to have any conveying mechanism within the hot zone of the furnaces. The entire equipment is "fool proof." The only manual operation is the placing of the material on the charging platform. The treatment it will receive is an exact certainty and never depends on the chance judgment of the operator. Rejections, due to faulty treatment, are thus entirely eliminated.

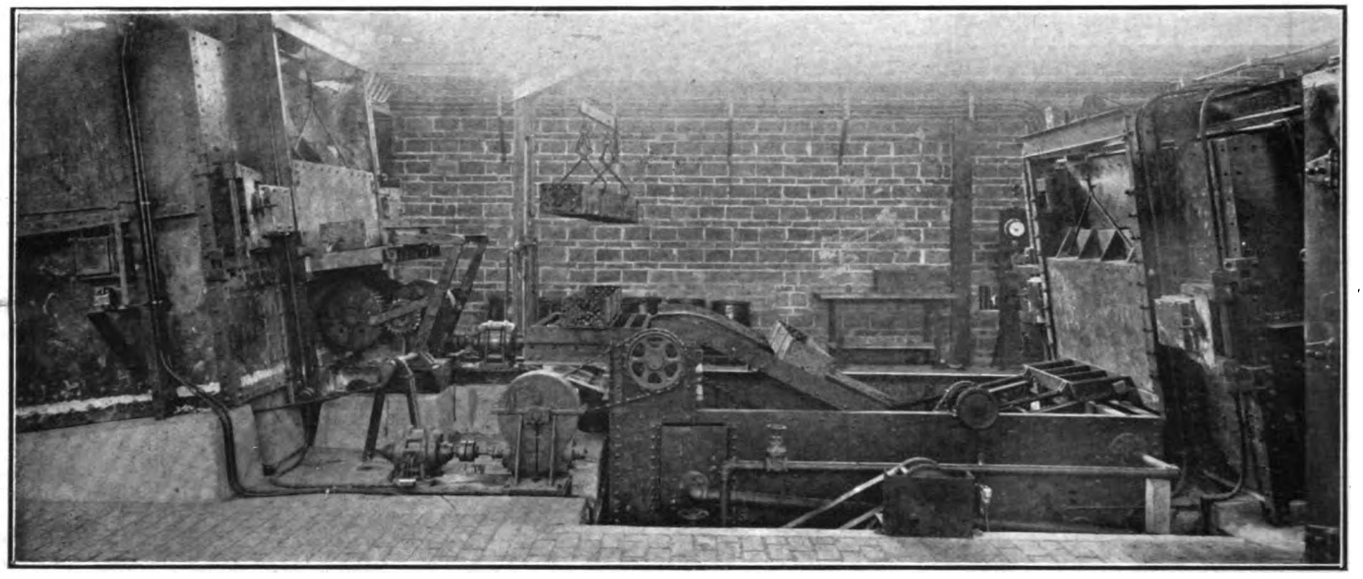


Fig 2. The automatic quench situated between the heating and drawing furnaces.

The Principle of Operation

A loaded container is placed on the charging platform before the pusher of the hardening furnace, Fig. 1. The equipment is set for a given treatment and when the pan nearest the discharge end of the furnace has received this treatment the doors automatically open, the cold pan is then pushed into the furnace, and all he pans within are moved along so that the last pan is discharged into the quench. The hearth is inclined 15 degrees to minimize this push and prevent the crushing of the furnace pans.

The automatic quench, as shown in the second illustration, has a counterweighted carriage which butts against the discharging door of the hardening furnace. When this door is raised, the carriage slides in and receives the outcoming loaded pan. This added load overcomes the effect of the counterweight, and the carriage slides down into the quench. Here the loaded pan is caught on a conveyor, and the carriage, relieved of its burden, rises and again butts against the furnace door until another pan of material is ready to be discharged. The first pan remains in the quench for the fixed length of time and then the conveyor mechanism carries it up on to the drain board, or, if desired, bears it direct to the charging platform of the drawing furnace.

The drawing furnace, Fig. 3, operates in exactly the same manner, except that the material is discharged to the air. Unless the equipment is set for a different treatment, the same process will be exactly repeated every day.

Automatic electric furnaces, such as those installed at the C. H. Wills' plant, take all the guess work out of heat treatment. With furnace atmosphere, time and temperature under an exact control, the manufacturer may develop the physical properties of steel to the maximum. Heretofore this was possible only on an experimental basis and produced only by a laboratory expert. Without any skilled operator, these furnaces repeat any required heat treatment on a tonnage basis, and as long as desired. When the desired treatment has been determined, the equipment must be set for the proper time and temperature in furnaces and quench. After that, it is necessary merely to feed the material.

The Heating Medium

The heating principle of these furnaces is very simple. Carborundum troughs are placed lengthwise on either side of the furnace hearth. These troughs are connected outside the furnace to special oil switches and these switches are, in turn, connected to the transformer taps corresponding to the power imput and temperature desired. Simply the closing of a switch passes a low voltage current through the carbon in the trough and brings this carbon to incandescency. The heat thus generated is radiated from the bottom of the trough underneath the elevated hearth, from its sides direct to the hearth, and from the top of the trough to the roof and hence deflected to the hearth. This results in a large source of relatively low temperature heat, uniformly distributed throughout the furnace.

The particular heat treating operations here described are performed in automatic, continuous pusher type furnaces. In addition to these, electic units for heat treating and annealing are built in hearth, pusher, car and recuperative car types. The standard sizes range from 20 k.w. to 900 k.w. in electrical capacity and have heating capacities from 10 pounds per hour up to three tons per hour.

With further reference to the properties of molybde-

num steel, expert metallurgists have ageed that compared with other alloy steels and heat treated to give approximately the same tensile strength, this newer alloy steel will have (1) slightly higher elastic limit, hence slightly higher elastic ratio, (2) higher elongation, hence greater ductility, and (3) much higher reduction of area, hence appreciably greater toughness. In addition, it has shown in tests tremendously increased resistance to impact, hence greater resistance to rupture under a suddenly applied load. The latter is really the cumulative effect of the other properties.

By a comparison with other steels, including a high grade carbon steel, a quality chrome steel, a good nickel steel, a chrome-nickel steel and a chrome-molybdenum steel with but .27 percent of molybdenum, the latter showed 33 percent increase in elastic ratio over the carbon steel, 16 2-3 percent increase in elongation and 56 percent increase in reduction of area. Compared with the next best alloy, that is with the chrome-nickel steel, the molybdenum alloy showed 1.7 percent increase in elastic ratio, more than 6 percent increase in elongation and 12.8 percent increased reduction in area. When tested for impact in the Izod machine, it showed 18 times the resistance of the carbon steel, and 34 percent more than the nearest alloy steel. It has been shown further than the small molybdenum content noted is not the best, but that progressively better performances in all the desired qualities can be obtained by using .40 percent, .60 percent, and best of all, .76 percent molybdenum content. For a constant tensile strength and very nearly constant elastic limit, the ducility of the steel is greatly increased by the use of the higher qualities of the molybdenum. To be exact in one test, the elongation was increased from 13.5 percen to 19.5 percent, and the reduction of area from 52.0 percent to 61.0 percent by increasing the content from .20 to .76. Conversely, by employing suitable drawback temperatures, for a given ductility the elastic limit and tensile strength will show an increase in like manner

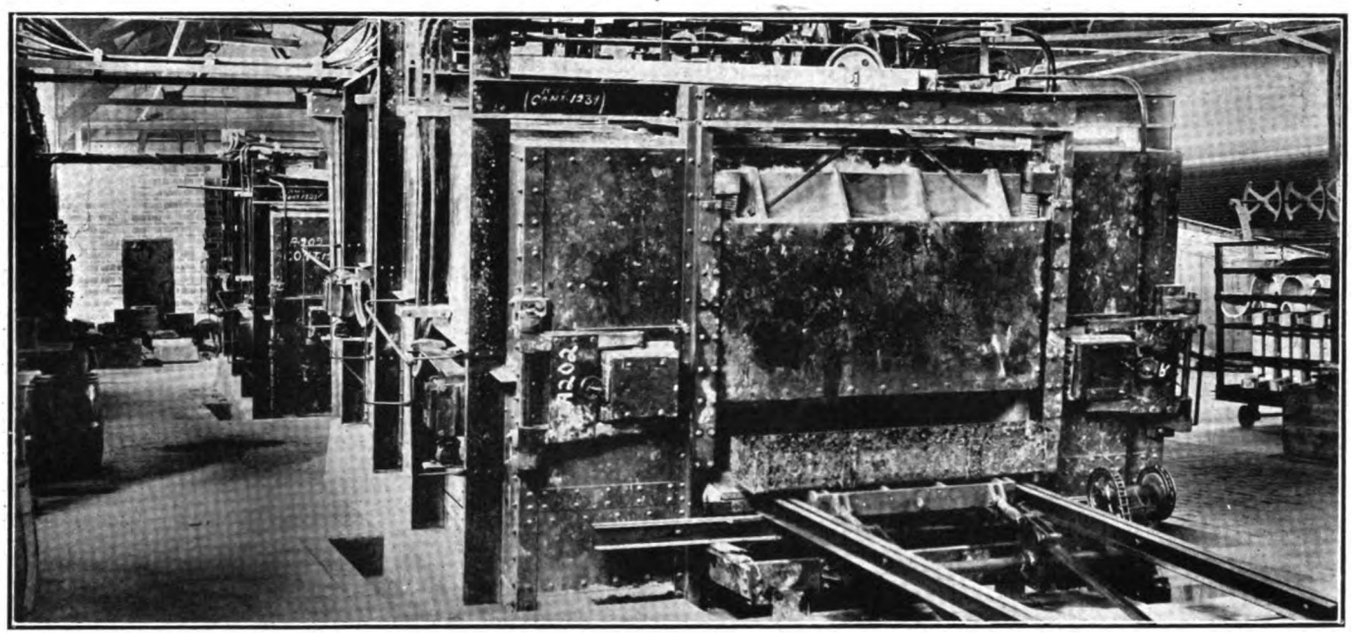


Fig. 3. The drawing furnace in which the treatment of the steel is concluded.

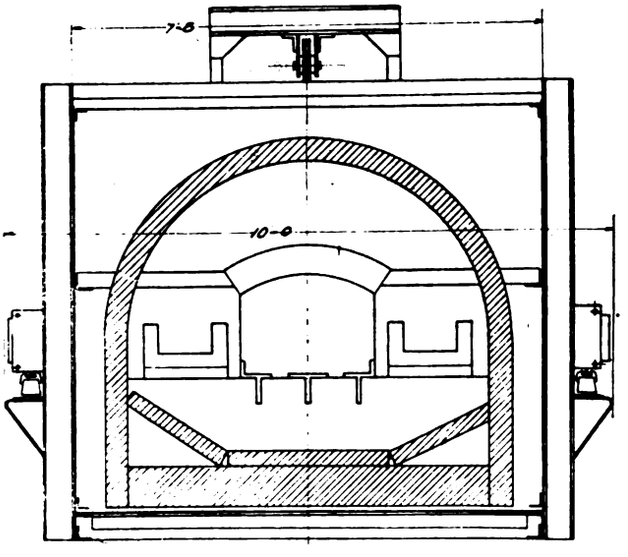


Fig. 4. Cross-section of the furnaces showing the construction and heating medium.

It is to produce these greatly improved qualities in the steel used in the Wills-St. Claire car that the equipment described herein has been constructed and employed.

Those interested in the subject are referred also to the articles previously appearing in these columns as follows: June, 1920, page 28; August, 1920, page 30; September, 1920, pages 34 and 35; October, 1920, page 32; December, 1920, pages 24-28.

April 14, 1921, an ariplane passenger service began between Paris, Brussels and Amsterdam, and later will be extended to Copenhagen, and will also include Bremen and Hamburg. Daily, a machine leaves Paris at 11 a. m., making landings at Brussels and Rotterdam, and arrives in Amsterdam at 3:30 p. m. An airplane leaves Amsterdam daily at 9 a. m. and arrives in Paris at 1:30 p. m. Thus the journey consumes only 4½ hours—one-third of the time now required by railway.

Automobile Trade in Australia

The recent dullness in the automobile trade in Australia has given rise to the suggestion that the Australian market is already supplied with as many automobiles as the demand warrants. However when it is taken into consideration that there is less than one automobile to each 66 of population, it may be assumed that an attractive market is still available.

It seems that what is needed is a reliable car that can be sold at a price within reach of the man of moderate income, and if the conditions become such that a car of this description can be placed on the market there is very considerable business to be done. However exchange rates, high duties, and the method of assessing these duties at the prevailing bank rate have done much to cripple American trade with Australia at the present time, to the very decided benefit of European countries, where the exchange rate is favorable to trade with this commonwealth. However no decrease of American imports had become apparent, according to the figures of the Department of Trade and Customs, up to the end of 1920.

There are at the present time about 21,000 automobiles registered in the Melbourne consular district, including cars for both pleasure and commercial use. The aggregate for the Commonwealth of Australia is about 70,000 touring and passenger cars and 3,900 trucks, the latter being little in evidence in the Melbourne district, the total number for Victoria being about 200 and these being in use in the metropolitan district only on account of the lack of good roads in country districts.

It is not at any time advisable to ship automobile bodies to Australia, since high import duties make the ultimate selling price almost prohibitive and excellent bodies are now being built in Australia for foreign chassis. Statistics compiled by the Australian Motorist show that 88 percent of the motor bodies fitted are of Autralian manufacture. Imports of automobile bodies have steadily declined in spite of the fact that the number of cars in use annually is now much greater. In the pre-war years of 1912 and 1913 the value of the automobile bodies imported was respectively $1,096,281 and $1,052,794; in the war year of 1915 the value was $904,190; and the post war year of 1920 imports dropped to $716,348.

The Australian Customs Department does not keep a record of the number of motor chassis imported, but the value of such imports during 1912 was $7,063,495; in 1913, $6,489,721; in 1916, $6,481,985; and in 1920 the value reached $16,283,377.

Imports by Countries

Details of the imports of motor bodies and chassis into Australia in 1920 by countries of origin follow:

Imported from	Bodies	Chassis
United Kingdom	$88,609	$3,084,242
United States	563,702	10,139,135
Canada	56,953	2,329,276
France	1,338	347,502
Belgium	2,204	27,958
Austria		49
Italy	1,991	337,322
Switzerland		14,589
New Zealand	374	866
Other sources	1,177	2,438
Total	716,348	16,283,377

In converting the amounts above the rate of $4.86 to the pound sterling has been used.

Types of Cars Most Popular—Tariff Rates

Six cylinder open touring cars are the ones most popular in this district. It is estimated that the make of foreign automobile having the largest sale here is the F. I. A. T. The A. E. C., Thorneycroft and Guy are also largely sold. The prices paid for cars range up to as high as £1,500 ($7,300), this price being obtained for Vauxhall, Crossley and Wolseley cars. The French Chenard & Walker chassis is sold at about £1,000 ($4,865), a 501 F. I. A. T. at about £680 ($3,310). Perhaps the most popular type of motor truck is the Leyland 2 ton truck sold here at about £1,025 ($4,985), though trucks from 1 to 3½ tons are used. The usual prices at which British trucks are sold range from about £1,000 to £1,500.

There are no laws or regulations affecting the locations of steering gears or brakes except that they must always be in good order, which is merely traffic reguulation. Though there are neither commonwealth nor state regulations prescribing the side on which the steering gear should be the left hand drive is not popular in Australia and is rarely seen. With regard to lighting, each motor vehicle must have a white light in front and a red light at rear.

The general tariff on automobiles is 55 per cent ad valorem, or £75 ($365), whichever rate returns the higher duty. The duty on chassis, but not including rubber tires, is 17½ and 20 per cent on unassembled and assembled chassis respectively. The duty on rubber tires is 40 per cent. Great Britain enjoys a preferential tariff of about 15 per cent less in each instance. The duty on printed advertising matter is 10d. (20 cents) per pound weight. or 45 per cent ad valorem.

The above duties are now assessed by the customs department on the value of the goods at the exchange rate, instead of at par or mint rate, as formerly, thus placing the American shipper at a further disadvantage.

Financial Aspect

A considerable number of orders for automobile chassis from the United States have recently had to be cancelled or curtailed for the reasons just mentioned and also on account of the inability of shippers to arrange satisfactory credits, the banks showing a strong disinclination to afford facilities for the purchase of additional foreign goods on account of the storage of Australian credits in London, caused by the heavy flow of imports into Australia, with a proportionately low amount of exports. It is hoped however that this situation will right itself shortly as wool and wheat payments become due in London.

Indemnity Bonds for All Motor Vehicles

A bill has been introduced into the New York Assembly the passage of which would require every owner of a motor vehicle in the state to file with the Secretary of State a bond or insurance policy of $10,000 for payment of any judgment for personal injuries or property damage recovered against the owner. Persons or corporations engaged in carrying passengers for hire in any motor vehicle, except street cars, must also deposit a bond for $10,000 for each vehicle so used.

Operating a motor vehicle without filing a bond, or after such a bond has been terminated or revoked, is made a misdemeanor.

Partitioned Farm Body for Fruits and Small Truck

ONE of the biggest items in the high cost of small fruits, vegetables and the usual products of truck farms is the large percentage of these crops which are bruised, crushed, broken or otherwise spoiled in the process of hauling to market. As most of this hauling is now done by motor to save time, this loss really comes back to the matter of having a proper truck body so as to prevent this damage.

Consider now, small farmers in general, says The Blacksmith and Wheelwright, some of them will plant potatoes, and when summer has come and gone, away these potato farmers will go to market, truck after truck, equipped with the bodies built last year.

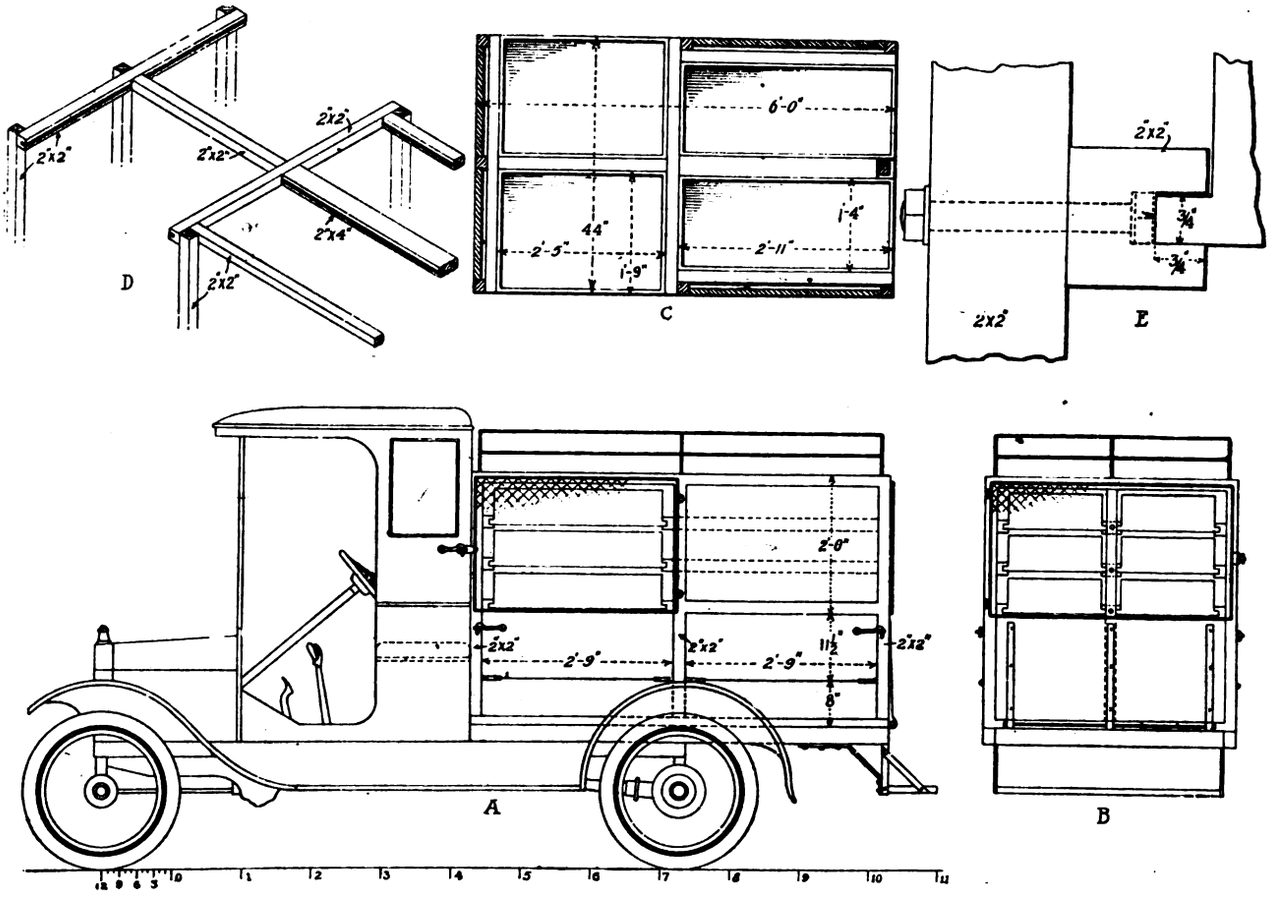
Others will plant corn, great big fields of corn, and after it is ripe and has been fed to the hogs and cattle, your roomy comfortable cattle bodies will go rolling by, the ones you made not long ago, and the fattened animals will ride with pleasure to market.

But some of these farmers like to putter around their small fruits and berries, and garden truck perhaps; you can see them right now, working from morning till night, day in and day out. And pretty soon, almost before you know it, some of them will have ripe strawberries, and into town with them they will go.

From then on they will have an abundance of small stuff to peddle around and their credit balance at the end of the season will depend largely upon the efficiency of this work.

Right here, sir, is where the body-builder enters the plot. He steps up to the worried farmer and says, "Cheer But now he's got an automobile—they all have "some kind of an auto or other," and around they go, with "some kind of body or other."

Do you know, Mr. Body-Builder, you ought to be interested in these produce-peddler friends of yours? They are up against a tough proposition, and you can help them out. Let's consider their case for a minute—what is their load? Fruit, berries, vegetables, truck; probably eight or ten different kinds altogether; some heavy, some light; some bulky, others not; some packed and a whole lot loose; and all perishable more or less by bruising or lack of ventilation.



Drawing showing construction of compartment body for small fruits and market garden produce. Shown on Ford chassis but can be enlarged for others.

Is it any wonder that before the farmer has half covered his rounds the celery is bruised, the cherries upset

A few years ago Mr. Garden-Truckman would have hitched up his horse and wagon, and made the rounds. and strawberry juice helping the radishes to color up last year's potatoes. You'll see the discriminating housewife turn away discouraged, with but a purchase or two to her credit, and much of the load that started out as healthy appetizing specimens will end their brief existence in the pig pen or barnyard.

Oh, no, not all trips are like this. Many men are careful, and are very deliberate in handling and packing the load—but oh, the time they waste, with an ordinary body!

up! I can make a body for you that will carry any number of different fruits and vegetables in one load, all nicely arranged in well-ventilated compartments, and all readily and easily accessible, even to a particular berry or an especially enticing head of lettuce. And when you get home after a quick and satisfactory round of your customers you'll have money in your pocket in place of the bruised and spoiled produce that used to take the joy out of life for you."

A few ideas of how to make such a body will be found in the plans below. Of course you can improve on them, but the idea is there for you to start with, and you ought to be able to interest the man who needs such a body. Get his ideas and work them out with yours; and ten to one he'll want you to start making the body for him before the end of the day.

The measurements given are from the rear of the cab. The body is 6 feet long, 44 inches wide and 3 feet 7½ inches high. The lower part consists of four hinged doors 11½ inches by 2 feet 9 inches, two on each side of the body. This makes a large compartment at the bottom for carrying potatoes, turnips, carrots, and other heavy and bulky articles; and it may be further subdivided if desired.

The rear of the lower part is an ordinary tail gate, providing for access to the heavy stuff from the rear also, and a step, as shown in the plans, will allow comfortable working of either the lower or upper sections.

The upper part of the body consists of twelve drawers, six reached from the sides and six from the rear. The doors to the upper sections can be made of wire, and swung on wire hinges. This will allow plenty of ventilation. Or they can be made in wooden shutter form. The drawers should be made so that the doors will keep them from sliding, or small catches can be made to hold them in place.

On the top of the body is a half-inch railing made from pipe stock, for the purpose of carrying a reserve load of certain articles.

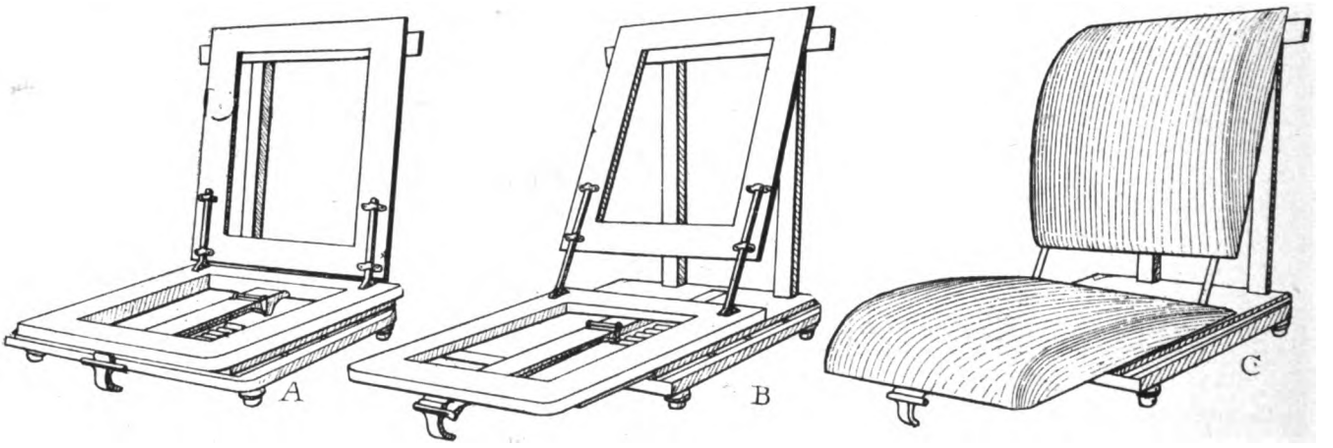
The construction of the cleats which hold the drawer slides are shown in views D and E. A is the side view, B the rear, C the plan, D the details of the cleats and E shows how the cleats are held secure to the posts.

The body is shown mounted on a regular Ford chassis, but it may, of course, be made to fit any small car; and would be a little roomier, perhaps, on a body of slightly longer wheelbase. If your customer has, or can get, a light Ford truck chassis, it will be still better, though some kind of a step or running board will have to be added on the sides, for access to the topside-compartments.

During the summer dullness, that is dullness in truck bodies, is a splendid time to be soliciting this kind of body work, for then the truck farmer or market gardener has begun to get his profits from his hard spring's work, and is in a mood to discuss something better for the next season, something which will save him work or money, or as in this case, both.

Novel French Sliding Seat, Adaptable to Any Position

One of the difficulties of a long ride in a motor car lies in the fatigue which comes from the restraint enforced by the fixed position of the seat cushion and back. A French inventor has sought to overcome this by making the seat construction in such a way that the lower part may be slid forward if desired. When this is done the back, hinged to it, also comes forward, the angle between seat and back varying with the position in which the seat is placed.



New French design for a sliding seat which may be moved until its outline suits the occupant. From the French, Moniteur de la Sellerie.

All this is very well shown in the illustration herewith. This is taken from the June 5 issue of Moniteur de la Sellerie, Paris. According to the description of the seat and its use appearing in that journal, the idea is to place the seat or sliding portion in such a position that the combined outline of the seat and back is most comfortable to the occupant. The first two illustrations, that is A and B, show the bare framework, to which the cushions are attached. These frames are constructed of wood in much the same manner that seat frames are ordinarily made. Part C of the illustration shows the seat with cushions attached.

The exports of gasoline from New Orleans, mainly to Latin America, have increased approximately 3,000 per cent in the period between 1911 and 1919, according to figures of the New Orleans Association of Commerce. In 1911 this port exported 251,098 gallons of gasoline, and in 1919 the total sent out through New Orleans was 62,259,024 gallons, or approximately 30 times the quantity exported nine years before.

Suggests New Profession for Study of Trucking Problems

Pointing out the economic advantages of the electric vehicle when it is used in its proper field and warning against the sale of electrics for service outside this field, Arthur Williams of the New York Edison Company, addressing the annual convention of the National Electric Light Association in Chicago Thursday, June 2, urged the establishment of a new profession, transportation engineering, for the purpose of studying and giving unprejudiced advice in all matters pertaining to terminal problems and motor vehicle transportation.

"There is probably no city in the country in which a large part of the business transportation cannot be handled by the electric vehicle with great advantage to the user and to the public. Large establishments perhaps require the two types of vehicles—gasoline for long distance deliveries and electrics for local service. Some may find the gasoline alone fitted for their service while others can accomplish everything with the electric.

"A responsibility now rests upon us to aid in the solution of problems arising out of merchandise transportation through the provision of expert advice to our customers and the public. The information we give should always be intelligent, thorough and never prejudiced as between the gasoline and electric vehicle. Great responsibility rests upon us to maintain this unprejudiced attitude for any mistake falls heavily upon the consumer.

"In our industry there is an attractive field for the profession of transportation engineering. In New York, where such a service is now in course of larger development, every user of transportation may have his entire problem studied, and a chart prepared showing the most effective means of reaching different delivery centers. With such a preliminary study of the conditions involved one may come quickly and intelligently to a conclusion as to which is the best method to employ. It is here that the judgment of the company's expert must be unerring and absolutely unprejudiced. If the gasoline vehicle is best for the particular work the customer should be so informed."

Pointing out the ways in which the lighting companies could help in increasing the use of electrics, Mr. Williams said that first it was necessary for the companies to use electrics themselves, that they should be prepared to give expert advice regarding both mechanical and transportation questions, that they should lend their positions in their communities to the study of terminal and transportation problems and that they should employ liberal advertising in the local press.

"The question has much to do with the final cost of living," he said in conclusion, "and in aiding its solution we can render conspicuous and desirable public service."

Pintle Hooks Adopted as Standard Equipment

At the annual meeting of the motor truck members of the National Automobile Chamber of Commerce, pintle hooks were adopted as standard equipment.

It was recommended that where such hooks are attached to motor truck or tractor frames they should be of the United States government type. The hooks should be so mounted that the axis of the drawbar head shall be located both vertically and horizontally approximately in the center of the frame of the chassis. It is necessary therefore that means be provided for fastening one end of the safety chain to the rear end of the motor truck chassis frame; the clevis is to be located directly under the axis of the drawbar head, or as near to this position as possible.

The stand taken by the Trailer Manufacturing Association of America was that it was not necessary for the truck manufacturer to place a spring behind the drawbar head or pintle hook on the motor truck. In substantiation of this the association stated that trailers made by reputable manufacturers have a starting and stopping spring in the drawbar or trailer head, which is of proper length and strength; any additional springs furnished by the truck manufacturer would therefore give too much spring action and cause the trailers to bump the truck. In the interests of better protection of the truck frame and driving mechanism truck manufacturers however are urged to equip their drawbar heads with springs according to the recommendation adopted by the National Chamber.

Automobile Production Now 87 Percent

Production reports from the car and truck factories of the country show that the automobile business in the second quarter of 1921 was 87 percent of the corresponding period in 1920, due largely to the fact that one of the chief manufacturers is operating at 136 percent of the 1920 basis. The other makers, however, are going on a 57 percent basis and are manufacturing at 107 percent, or more than double, the rate of the first quarter this year. Motor truck production is more than one-third better than it was during the first quarter.

This return of activity in the third largest industry is expected to be a marked stimulus to other lines. During the second quarter cotton production was at 82 percent, employment at 75 percent, zinc at 41 percent and pig iron at 39 percent of the same period a year ago. The effect of the large sales of automobiles is expected to be felt in these commodities during the third quarter.

Automobiles not only consume large quantities of raw materials, but also call for production in semi-finished and allied lines such as electric wire, accessories, tires. The industry itself employs over 300,000 men in its factories, with as many again in the accessory plants.

100,000 Salesmen Building Markets

There are 35,000 dealers in the country employing 100,000 salesmen. This army of salesmen has been one of the most potent forces in turning the tide of depression. The "order takers" were quickly eliminated last fall, and the men who remained were experienced sellers of transportation. The good automobile salesman has to be a high type of man, since he must have some engineering knowledge, and he must see to it that the car gets proper attention after it is sold if he is to secure re-orders.

In addition to the thousands of efficient salesmen, the usual spring and summer demand for motor transportation has started the upward turn in the automobile business. With 9,200,000 cars in use the replacement business each spring runs into the hundreds of thousands. Orders from new owners also come in most heavily at this time of year.

W. L. Smith, U. S. mail pilot, established a new record between Cleveland and New York recently, lowering his own previous record of 3 hours to 2 hours 48 minutes.

The Economics of Highway Transport

By ROY D. CHAPIN *

THESE readjustment times are times to take stock of American assets and liabilities, especially such tremendous factors, running into such enormous sums of money and such important items in the lives of all of us, as highways and highway vehicles. In assets, both run into billions; in liabilities, enormous annual maintenance charges are involved. While these charges are justified, we must not neglect their importance. We must all look at these matters from this point of view: We get the benefits, we pay the bills.

Highway transport is intimately concerned with the production and distribution of wealth, and has become an outstanding means of satisfaction of human desires. History shows that civilization has steadily followed the opening of fresh trade routes. As the centuries have passed, civilization and transportation have become co-partners, moving down the ages hand in hand.

The invention of the wheel was the first great step in facilitating progress across the country. Then came the compass, and mariners felt safe out of sight of land. The steam engine in boats and railroad trains satisfied in part that desire for quicker movement from point to point that is such an insistent characteristic of civilization.

However, the desire for individual expression in terms of rapid movement was not gratified until the inventors finally perfected the motor vehicle. Here was a new tool with which to create and transport wealth. More than this, it satisfied in unusual measure that wish that every man has had since the earliest days of history to move quickly, but when and where he pleased with. New laws must be written and in particular new economic laws that, taking cognizance of this suddenly developed Titan, will safely, sanely, and soundly conserve the billions of dollars the world has invested.

When Columbus discovered America, he found the Indians knew nothing of the wheel, and their civilization had made little progress. Just as the Indians used the waterways, so did the earliest settlers in this country.

Washington, with that prophetic vision of his, realized that highways, both by land and water, must tie together the dwellers in this new counry if it were to be truly united. He saw that trade routes must be opened to the Mississippi Valley otherwise that section would align itself with New Orleans, then in foreign hands. His first move was to organize a company to build a canal between the Potomac and Ohio Rivers. Later, while Washington was president of the United States, he opened the northern route via the Hudson River and Lake Erie, and so our present central states were made accessible to the seaboard.

Highways Early Recognized as Public Works

President John Quincy Adams, too, was the firmest of believers in highways, and sought to make the government responsible for the building of the main roads. He reached the same conclusion as Washington—highways served as an arterial system of the nation, and they should be built by the state and not private capital. Early in the 19th century we find regular service provided over the Boston Post Road between New York and Boston, over the route from New York to Philadelphia, Baltimore, Washington, Pittsburgh, from New York to Albany, and then over the Genesee Turnpike to Buffalo. The government finally took a hand and began the construction of the "National Road" in 1811, which was projected to run from Cumberland, Maryland, to Columbus, Ohio, and Indianapolis, Indiana. It was not finished through to Columbus until 1843, thirty-two years after its start. Plans were laid to construct other federal highways, and it looked as though canal, lake, and highway transportation would be the means of opening up the west.

The northern states saw the importance of highway and canal building and this contributed astonishingly to their development. Between 1790 and 1830, Pennsylvania increased its population from 400,000 to 1,350,000; New York State from 340,000 to 2,000,000; Ohio from a few hundred to almost a million.

Motor Vehicle Herald of New Transport Era

However, a revolutionary change in transportation was at hand. Suddenly the railroad came forward as a medium of faster movement than anything then known, and very logically the nation turned its energies toward a great railroad expansion. Road building by the government suddenly halted, and the highways gradually grew local in character, as the railroad builders drove their lines into every state.

However, human desire once more asserted itself. Individual expression demanded individual transportation, and American inventive genius was the first to supply the low-priced motor car and truck. We now see that our highway map must be rewritten and redrawn. No longer are the roads used for an average of six or eight-mile hauls, as they were twenty years ago. Today the radius of highway action is unlimited, both for freight and passengers. Here is a new era making accessible every section of our country. We had learned that land values accrue in proportion to the accessibility of waterways and railroads. Now good highways add 100 to 1000 percent to land values, demonstrating that the user of the highway is not the sole beneficiary by its improvement. The distribution of wealth is greatly accelerated, education made easier, transportation costs lowered, and civilization given a new interpretation.

Yet the cost of all this, the largest single item for public works in the nation,* is a tax upon every citizen. Let us look at the economic justification of our investment of ten billion dollars in vehicles, two and one-half million miles of highway, seven hundred million dollars available today for the building of roads, and an annual cost of maintenance of both vehicle and highway that would be staggering if it did not return many times this expenditure to every one of us.

* Chairman Highways Committee, N.A.C.C., president, Hudson Motor Car Co., Detroit.

* Note—Governmental expenditures for public works for the fiscal year 1920 amount to $168,203,557 or 3 percent of the total budget. Of this sum 59 percent or $99,000,000 is devoted to highway construction, 26 percent or $43,460,000 to rivers and harbors, 6 percent or $10,300,000 to public buildings, and 3 percent or $7,500,000 for reclamation. Other and smaller items make up the balance.

No one questions the necessity for better highways, nor the utilitarian value of the vehicles that traverse the roads. The problem that rears itself straight in front of us is the proper administration to secure the largest returns from this tax upon each individual, also the education of men to help direct highway expenditures. In other words, let the public get back more than a dollar in dividends for every dollar spent, and let it be handled by men adequately trained. We have appropriated money and built highways with more consideration for the actual mileage constructed than for the quality of the road itself. The leaders today in highway building are not content to locate highways based on political pressure or local sentiment. A careful traffic census plus a sound vision of future travel, answers "Yes" or "No" to what roads should be built. Railroad engineering has shown that too heavy grades add millions to haulage costs. Too sharp curves cut down speed and throw heavy wear and strain on tires.

Highway and Vehicle One Problem

Foundation and drainage have come to be more than mere phrases, for the public no longer is willing to pay for highways that last only a few years. It is the hidden strength placed in the foundation that the user of the road never sees, which tells whether the taxpayers' money has been wisely administered. The builders of fine motor cars put many dollars in the construction of their chassis in quality of material, extra weight at point of strain, and great care in workmanship, which the owner of the vehicle only senses in the satisfaction that its yearly use gives. It is not apparent on the surface.

The time is here when we must treat the highway and its vehicle as a unit, one wearing upon the other, and study each in turn in its relation to the economic fabric of the country. We must design the road to fit the vehicle and equally design the vehicle to fit the road. Here we have a problem that concerns engineers, taxpayers, legislators, and each and every one of our population, for all of us use the highway.

Over the past twenty years our citizens had a false impression of our duty toward the railroads. Discrimination against them touched the popular fancy. Railroad executives will tell you that they too could have handled their trusts better in relation to the public. Since the beginning of the war, we have seen the railroad companies take several billions of dollars of the taxpayers' money to keep the wheels moving. Not because they wanted to, but because the public had to have this service and must have it at any cost. Since the war we all understand better the importance of railroad transportation and the necessity of according it fair treatment.

Transporation of Future Must be Co-ordinated

The war was responsible in bringing home to us how close our highways are to our everyday life. An unusual strain was placed upon them, both civil and military, and we all came through the war with a heightened desire for better roads everywhere as soon as possible. The highways transport committee of the Council of National Defense which was entrusted by the government with the energizing of highway transport during the war, adopted the following platform that is still significant in its vision of the duty of each form of transportation:

"It is the aim of our committee to co-operate closely with railway, electric railway and waterway transportation, and it is to be clearly understood that in no way is the committee encouraging competition between the various forms of transportation, but rather the carrying of any type of freight by the particular means which do it the most efficiently, quickly and economically."

Here is a platform that can stand for some time in its economic interpretation of the field of highway transport.

The public must have highway service, but such service must recognize its own possibilities. There is time to sit down and forecast much that needs to be done and put sound analysis on these problems. Let me suggest a few of these:

Questions to be Answered

How much shall be spent to build a particular piece of highway?

What expense is warranted to maintain that piece of highway?

What type of surface should be laid for the different geographical sections?

What maximum traffic must be prepared for?

How shall highway bonds be made "gilt-edge"?

How shall we divide the responsibility of the government, the state, and the county for highway construction, control, and maintenance?

What proportion of the cost shall be borne by the vehicle?

How can the cost of vehicle operation be cut down.

What are sane regulatory laws?

How shall we tie highway, railway, and water transportation together so that they will not compete but will serve each other?

How, finally, shall we make highway transport serve to cut the cost of living—how add even more to the satisfaction of human desire?

These are all basic problems that call for the correlation of thinking men's minds. Certainly efforts should be made to continue in office those highway officials who have demonstrated their ability and foresight. We should not let competent men resign, as has one of the well-known state highway engineers of the country, because his state was not willing to pay his assistants enough to hold good men on the job, although they gave him the highest salary of any state official.

Nation Should Lead in This Work

The United States government should unquestionably be the leader of forward thought pertaining to highway transport. Already it has appropriated $285,000,000 for highways from the national treasury. Hundreds of millions are to follow, because the American people insist that the government not only help build its main highways but they also want the benefit of a centralized authority permanently engaged in research and investigation to help them solve some of these problems already enumerated. The government should assume its responsibility by determining what are the national highways, asking the states to designate state highways, and the states in turn obtaining from the counties a designation of county highways. We shall then have a plan of country-wide roads upon which can be based the expansion over those roads of a transportation system that shall make of every farmer's gate a shipping platform, a medium for the transfer of people and goods that will advance us far beyond any other nation.

Let the government and the people insist on the solution of the economic problems involved and we shall

set an example for all other nations. The world is just awakening to the manifold advantages of highway transport. We, in America, have the opportunity to lead the way. Let our sons not think us heedless of our duty or blind to the economic problems involved in this absorbing question, but rather let us intelligently set to work now that our children may reap full benefit of our foresight.

Automobile Makers Want New Insurance Basis

Lower insurance rates on a better basis are sought by the National Automobile Chamber of Commerce in severing relations with the Underwriters' Laboratories which would group cars according to mechanical construction.

Over-valuation and ignoring the character of the policy holder are the two weakest points in the insurance methods today, in the opinion of the automobile makers.

Most of the new cars carrying insurance are valued at more than their market price if the owner had to sell them. Consequently the temptation to destroy the car is strong for the unscrupulous. Many instances are on record of cars being driven into a river in order that theft insurance might be collected. The same danger applies for fire insurance.

Though faced with this situation, no recognition is made of the moral hazard. No inquiry is made concerning a man's character before writing his policy, so that the dangers of valuation are not stopped at this point.

More important than the crime element is the carelessness which over-valuation encourages in the average motorist. If his automobile is over-valued theft or accident may prove a blessing.

The activities of the Underwriters' Laboratories are regarded as too detailed. The inspections result in classifications which are illogical. Parts makers which do not submit to the Underwriters' Laboratories tests do not get rated, and a car may accordingly be unfairly listed because not all of its parts are supervised.

Few of the accidents today are due to faulty construction. The automobile makers feel that little is gained by the Underwriters' Laboratories tests as the cause of the high rates lies in factors not related to mechanical production.

Insurance companies are working on these suggestions and a readjustment in policies and rates is hoped for in the near future.

Plan to Reduce Time and Cost of Air Seasoning Wood

In cooperation with the sawmills and wood utilization plants throughout the country, the Forest Products Laboratory, Madison, Wisconsin, is organizing an extensive field study on the air seasoning of wood. This study, it is believed, will be of extreme interest to the lumber manufacturer and to the wood-using industries. The purpose is to determine the piling practice which will result in the fastest drying rates consistent with the least depreciation of stock, the least amount of required yard space, and the least handling costs. The study will be carried on concurrently on both hardwoods and softwoods. All the important commercial woods of the United States will eventually receive consideration.

The air seasoning of wood is an old practice. No systematic attempt has ever been made, however, to work out the exact conditions under which drying time and drying costs can be reduced to a minimum. It is not actually known which of the numberless methods of piling will give the quickest and the cheapest results under given climatic conditions. The new project will furnish a comparison of the effects of such piling variables as sticker heights, the spacings of boards in layers, the heights of pile foundations, and the directions of piling with relation to prevailing winds and yard alleyways.

The study is expected to decide whether from a business standpoint lumber should be dried partly at the mill and partly at the plant of utilization, or whether it should be completely dried at the mill. The data collected will also go a long way toward showing whether air seasoning or kiln drying is the more profitable.

A tentative working plan of the air seasoning study has been prepared by the Forest Products Laboratory, and copies are being sent to the secretaries of the various lumber and wood-using associations, state foresters, forest school heads, and others eminently qualified to comment on the plan.

Cooperation in the air seasoning study is being offered on every side. As yet the plants at which the work will actually be done have not been definitely chosen, but the extreme interest already manifested indicates that there will be no difficulty in securing cooperation with plants ideal for the study. Actual field work will soon be well under way.

Death of Edward S. Darlington

Edward S. Darlington, treasurer of Hoopes Bro. & Darlington, Inc., West Chester, Pa., manufacturers of wheels, passed away on June 17th at his home in West Chester.

Edward S. Darlington was for more than half a century engaged in the manufacture of wheels and was an authority on all subjects connected with wooden wheels, whether used on horse-drawn vehicles, automobiles or motor trucks.

Entering the company at the age of 18, in the year 1869, the young man devoted himself, with that energy and earnestness which had always been characteristic of him, to learning the entire business. In 1903, at the time when the company became incorporated, Edward S. Darlington was chosen treasurer of the company.

English & Mersick Now Offers Fittings

With the accession to its staff of F. E. Greene, the English & Mersick Co., New Haven, Conn., manufacturer of radiators for the automotive industry, also adds a line of metal interior fittings for automobiles. Greene, who has had a long experience in the production and design of art metal products, is to have complete charge of the new business which will include dome lamps, reading lamps, vanity cases and other artistic mountings for enclosed cars.

The newly invented colloidal fuel, which is now under investigation by the government of Japan as a substitute for coal and heavy oil, is expected to give Japanese shipping a most efficient fuel at a low price and to remedy the alarming decrease of the supply of coal and petroleum, states Shipping and Engineering.

New and Improved Ideas in Body Finishing

Popular Car Colors

Reference may be made to the value of bottle green as a color for the car, writes M. C. Hillick in The Painters' Magazine. The fact that it is an old-fashioned color, as color goes, need not discredit its standing among the useful and fine appearing pigments today being employed in vehicle painting. The ground for this color may be made of lemon chrome and black, using enough of the yellow in the black to produce a green in shade closely approximating bottle green. Owing to the varying strength of the colors we are unable to advise the precise quantitative proportions of each to use, but the mixer can add the yellow to the black until the desired shade is reached.

Produce the surface in a level and smooth condition —such a condition, in fact, that no additional puttying or other surface work will be required after the color is once on. Next prepare some Dutch pink and Prussian blue by mixing the two together until a rich shade of bottle green is secured. All these pigments should come ground in japan, and are to be thinned for application with turpentine.

The first coat of ground color having been applied and given due time in which to dry, we may now lay on a coat of the color proper as made of the Dutch pink and Prussian blue. Apply the first and second coat of color with a camel's-hair brush, and lay each as smoothly and cleanly as possible. A single coat of the pink and blue mixture will suffice to form the base for the glazing color.

In due course take a quantity of yellow lake, japan ground, and after thinning it to a creamy paste with turpentine, add enough elastic rubbing varnish to furnish the color with a reliable flowing property. To a pint of the glaze add and stir intimately into it about two tablespoonfuls of the Dutch pink.

A fine, half-elastic bristle varnish brush or a badger-hair brush of suitable width will answer the purpose for application of the varnish color. This mixture should be applied or freely flowed on in order to develop the depth of lustre and the beauty of color. This yellow lake flowed freely over the bottle green ground will establish a rich, wonderful, splendidly-toned green impossible to attain in any other way.

If a warmer hue is wished it may be secured by adding a very slight amount of English vermilion—say a couple of drops to a pint of the material. A single drop of Prussian blue will suffice to change the color to a bluish-green. If a more yellow tone is desired, as it often is, the hue may be made by simply omitting the Dutch pink and glazing with the yellow lake. If an olive shade or tone is called for the effects may be obtained by adding a drop each of vermilion and blue to a pint of the yellow lake.

For striping this green, black and gold lines are always in order, and confer a look of dignity. If the black lines are chosen, they may be edged to advantage with hair-lines of carmine or bright red.

Brewster and olive and quaker green are members of the family always having friends everywhere. These are, to be sure, old-time colors, but they are nevertheless coming into their own, and they have a great following among the carriage users who now are numbered with the car owners and speed transgressors.

These pigments have a large advantage over not a few of their younger rivals in that they do not require over-elaboration of the surface and of the ground color in order to have them make a presentable appearance, or to cover solidly without the aid of several preliminary coatings.

But in common with practically all other pigments entering into the color schedules employed for the horseless vehicle, they show to finest example when displayed in the form of varnish color. The color is not only enhanced in richness and brilliancy of tone, but its purity and original color features are better developed and maintained. One coat of the straight color and then one coat of varnish color does the work, with but little of the color to be added to the subsequent coat of varnish. This color addition is to be made to the extent only of keeping the purity of the color untarnished by the varnish.

Blue pigments have been popular since colors were first known under a formally recognized name, and of these colors none are more firmly established in the affection of the public than ultramarine blue, in not less than three shades. As might be expected, there are not a few newer blues which today are filling the public eye with captivating radiance.

Blue is not popular with the painters for the reason that, as a rule, it suffers discoloration and off-shade effects most readily, and oftentimes without provocation. It is generally understood that the lighter the shade the car owner can be satisfied with, when choosing a blue, the more completely he will be satisfied when the car is finished, for the blues are most easily affected by all the minor and major influences which beset painting effects as they find development upon the car surface.

The surface for the blue should be worked up and perfected prior to applying the ground color, for it is very difficult, if not impossible, to repair a defect so that it will not show after the ground color has been placed. For the ultramarine blue there are ground colors to be bought ready for application, but in the smaller shops, where the blue is not used frequently, it is not always convenient to carry the color in stock, hence the home-prepared ground fits in handily. The ground may consist of a coat of lampblack, or of a deep brown made of Indian red and ivory black.

For the highest class job of blue, take some of the ultramarine blue and thin it simply with turpentine to a brushing consistency, and with this, using a camel's-hair brush, apply a coat of the flat or dead color. Now take say 3 ounces of ultramarine blue, and after thinning it to a cream-like paste with turpentine, add to a pound of varnish—elastic rubbing varnish is to be preferred for large panel surfaces—and stir the ingredients intimately.

With a half-elastic bristle or a badger-hair brush, of a size suitable for the requirements of the surface, flow freely the coat, taking an entire panel for each dressing up. If necessary, as it is likely to be, use two coats of this mixture, and then with the next coat of rubbing varnish use a teaspoonful of the blue to a pound of varnish as a means of preserving the original purity of the color.

If no striping or decorative work is to be applied to the surface it will be good policy to use a very little color in the final coat of rubbing varnish, thus making every coat above the flat color, except the finishing varnish, carry enough of the blue to preserve the true tone and shade of the color, and to counteract the discoloring property of the varnish.

What we have here said of the ultramarine may practically be remarked of all other blues used in vehicle painting, although, as above stated, the light blues are less affected by discoloring agents, and are easier handled, than the darker shades.

The method above described of using ultramarine blue may be cheapened by omitting the flat coat of blue and flowing the ultramarine glaze directly over the ground color. Flow two coats of the glaze, mixed as previously advised, and then rub carefully with water and pumice-stone flour, wash thoroughly, and finish upon this base, provided there is no striping or decorative work to be applied.

If this latter work is to be used, apply it right over the second coat of glaze, and then use one coat of clear rubbing varnish over this; then rub and finish in regular order. The importance of having a solid covering ground and a solidly opaque blue surface on the top cannot be overestimated, for it is the main secret of painting a deep, rich blue and geting all the effects which belong to the color.

American Automobiles in Norway

American automobiles predominate in the Norwegian market but English, French, Italian, Dutch and German cars also are offered. Most of the importations during 1918-1920 period came from the United States. American cars owe their supremacy, it is stated, to superior motors, but the European car is less expensive, as a rule, owing to the lower cost of its transportation to Norway. The number of motor cars of all classes in use in Norway rose from 1,007 in 1913 to 7,915 in 1919, according to a report from United States Consul General Osborne at Christiania. More than 5,000 cars were imported in the first eleven months of 1920, and the total number now in operation is estimated at more than 12,000. The distribution among a population of some 2,600,000 is now at the approximate rate of 1 to 216 persons.

In 1918-1920 American manufacturers obtained advance payments before accepting orders, although Norwegian importers objected to this practice. Since the war, this requirement has been modified, and in some cases ninety day drafts are now being accepted in lieu of cash in advance.

Trucks of the heavier type are not in such demand as the light. Delivery cars of the lighter kind are also preferred.

The number of motor vehicles in operation in Nova Scotia in 1920 was 12,450, an increase of more than 3,000 over the previous year. The revenue derived by the province from license and other fees of various kinds was larger by $112,837 than during 1919, considerably exceeding the estimate. There is every indication that the present year will witness a big increase in the number of motor cars in use in Nova Scotia.

The Roof Problem in England

The shape and height of the roof has an important bearing on the general design of any vehicle. Limousines, landaulettes, and coupes are now built with a minimum of headroom in order to give the car a smart appearance. This is made possible by having the seats as close to the floor as the design of the body will allow, since headroom off the top of the cushion for the seated passenger cannot be reduced below a certain minimum. The apparent height of the body is also decreased if the roof is well domed.

The use of a domed roof and well-rounded corners to the back of the body has led to the merging of these contours into the familiar rounded-top back panel now seen on limousines and enclosed cars of various patterns, while with those bodies which have a folding head the curved back corner has been adopted as far as the use of leather and folding sticks will allow. Since in a limousine the top back panel can be carried upwards on the roof without any visible joint it does away with the necessity for a cornice bead to be fixed round the back, so that the refined appearance one associates with the horse-drawn brougham is maintained. The brougham roof and quarters were always covered with russet leather in the best work, the bead on the pillar, elbow and back rails hiding the bottom fixing of the leather. Still, many modern motor bodies are built with a roof having a somewhat sharp curve worked up in the cant rail only, and one will often see the cornice carried right round the body.

The roof framing consists of two cant rails to which are spliced the side canopy rails if a roof extension is used. The top cross rails will be arranged according to the style of body under consideration, the general shape of the roof being maintained by the provision of hoopsticks which are usually notched into the cant rail.

The cant rail is an important item of the side-framing. In these days of half-laps for almost any joint in the body, it is still mortised out to receive the tenons of the standing and other pillars. It must be wide enough to hold up to the size of the pillars, and thick enough to allow for the bevel of the curve of the roof. If the cant rail is shaped to form the end of the roof curve the steel panel or roof board may be let into it, although we have seen the roof board laid on top. The roof board with the ordinary curved roof is brought to the edge of the cant rail and dressed off to the sweep, and then after the roof is painted it is covered with various kinds of waterproof material, the edge of which is hidden by the wooden or metal cornice.

Although built-up roofs are being advocated constantly the general method is still to use pine boards or match-boarding, the centre board being driven as a wedge so as to make a tight job. It is pointed out that with a built-up or three-ply roof the number of hoopsticks can be reduced, and it must be admitted that the hoopsticks with the ordinary method of construction have to be kept fairly close together in order to form a good foundation for the nails which hold the roof boards down. This argument, of course, only applies when there is no roof load to be carried. Where the roof curve is sharp the metal panel easily makes the best job although it is more expensive. It is thought that if a wooden roof is used when the roof is domed a class of timber should be used

which can be steam-bent into shape. This is worth consideration, since a pine board bent "cold" will, on a part like the canopy, often be strong enough to break the front canopy bend in its efforts to return to its normal shape. It may sound strange, but it is quite possible for the roof boards to hold the canopy up, rather than that the structure should require any support from below. It is not a desirable way of supporting any part of the framework, but this fact is pointed out to show that the strain may not always be in the most likely spot.

If a body tends to bulge at the waist line it is seldom the result of any weakness of the roof framing, but because the body is not tied together enough at the waist. The modern motor body seldom has a seat rail high enough from the floor to be of much use for this purpose, while the body plate which runs down the back of the standing pillar across the bottom bar (specially framed in at the foot to take it) and up the opposite pillar is not designed to resist much side strain. This body plate would be far more valuable if it was fastened on the side of the pillar with a fairly large gusset piece at the lower corners. Long bodies are specially liable to bulge, however well plated the roof may be, and since the hoopsticks are plated on the sides they are more scientifically strengthened than the side or bottom framing if ironed up in the conventional way.

Hoopsticks even for the heavy class of work seldom need be stouter than 1½ inches square, although, of course, for folding headwork they will be made wide to give a proper foundation for the fixing of the headlocks and so on. In building large box vans, omnibuses, and similar vehicles it is usual to counteract any tendency for the body to bulge by framing the cant rails a ¼ of an inch hollow each side, the waist rails being similarly treated. Also any tendency to hollowness in the roof is allowed for by making the centre hoopstick about ⅝ inch higher than the top cross rails at the front and back respectively, the other sticks being graded to correspond.

A roof which has to carry luggage or a top load of any kind will be strengthened by increasing the number of hoopsticks, and protecting the roof itself with wearing slats. The use of a removable pad for use with carriages does not seem to have found favor with the motorist. With double-decked omnibuses the ordinary ⅜-inch roof board would not be strong enough, but anything thicker, unless it was a specially-prepared built-up roof would be difficult to bend to the roof sweep. This difficulty is surmounted by having two layers of ⅜-inch boards (occasionally the outer one is ⅝ inch), while the whole is painted between the layers, on top before the waterproof covering is stretched over, and again after it has been applied. Roof boards are usually nailed down, one of the few jobs where the coach bodymaker gives his screwdriver a rest. Roof boards and the covering materials should always be in one piece. In public service and commercial work the underside of the roof is exposed, so that the boards must be as well selected as for a private job. We shall not be surprised, however, to find that in due course as omnibuses, especially the single-deck type, become more luxurious when designed for private hire work, that the roof framing will be hidden either by the use of some textile material, as in a limousine, or by lining it with an inside roof board of some thin material as adopted for railway carriage and tramcar work.

The clerestory roof does not seem to grow much in favor for motor cars. It was, perhaps, adopted more frequently for private cars in the earlier days of motoring than now. It is occasionally adopted for bus work, but is chiefly used in tramcar construction, especially in the United States. It has been found, however, that an arched roof can be ventilated quite as effectively as the monitor roof as it is called, with the advantage that a considerable amount of weight is saved. The clerestory roof is also not the cheapest form of construction, but its main advantage is that the headroom may be increased in the centre gangway just where it is required.

Roof ventilation, although effective, is not by any means used as much as it might be. There would appear to be almost a prejudice against the use of the ordinary flap ventilator, which is hinged so that it opens towards the front of the car. It may be that the roof ventilator is considered an eyesore, and spoils the neat appearance of the roof. They would certainly be useful for the single deck omnibus, either alone or in conjunction with the torpedo air extractor or similar device.

The sliding roof in theory should be an ideal method of converting a closed vehicle into an open one, since one obtains adequate ventilation, a glimpse of the blue sky, and it is not difficult to arrange so that there shall be a minimum of draught and an absence of dust. The limousine which has a canopy is a convenient type of vehicle in which to arrange for a portion of the roof to slide since the movable portion can run forward on to the canopy. A flexible roof which rolled up on a spring blind was shown at Olympia last year on one of the leading motor-body builder's stands, while in the commercial vehicle show of the previous month a large bus was shown where the roof was provided with four large hinged lids so that about half the area of the roof could be opened in a few moments. The sliding or hinged roof is a useful device when used in commercial work, since it will often facilitate the process of loading and unloadng. By this means heavy goods can be lowered by the crane directly upon the floor of the van.—Automobile & Carriage Builders' Journal (London, Eng.).

A new type of flying machine has recently been tried for the Paris-London service. It is a Vickers-Viking amphibian machine, which is a form of seaplane having adjustable wheels so that it can land on water and run up onto the shore. By the use of this type of machine it becomes unnecessary to travel to the outskirts of London in order to take an airplane. The possibilities of landing at any time in case of mechanical trouble are much more favorable, as the Thames and the Seine offer landing possibilities at almost any point.

The longest dating you can get on a bill will not keep if from coming due. Don't buy more than you want just because you are getting long time.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Willys Corporation, 11 Pine street, New York, manufacturer of automobiles and automobile equipment, Plans are being perfected for a reorganization. It is said that the two subsidiaries, the Auto-Lite Corporation, Toledo, Ohio, and the New Process Gear Co., Syracuse, N. Y., will be merged into one operating unit, while the new plant on Elizabeth avenue, Elizabeth, N J., comprising the former works of the Duesenberg Motors Corporations and additions, will be operated as a separate plant division for the production of the Chrysler six automobile. The reorganization plans include a new bond issue to total about $20,000,000.

Durant Motors, Inc., 1764 Broadway, New York, is said to have placed an order for 50,000 automobile motors with the Continental Motors Corporation, Detroit, Mich., with delivery by Aug. 1 in connection with plans to commence the manufacture of automobiles at its plants at Long Island City and Oakland, Cal. The motors will be shipped at the rate of 150 a day. Production of the Durant cars will begin at about this same time.

Monarch Tractor Co., Watertown, Wis., which was bid in at bankruptcy sale for $44,000 by E. B. Cadwell of New York, a principal creditor, has resumed operations on a limited scale, following the confirmation of the sale and transfer of the property to Mr. Cadwell. J. L. Hornbeck has been retained as works manager.

Houde Engineering Corp., 1392 West avenue, Buffalo, manufacturer of automobile shock absorbers and similar products, has plans under way for the erection of a new two story factory, 37 x 100 ft., to cost about $20,000. G. W. Wolf, 1377 Main street, is architect. A. B. Shultz is president.

Morgan Grinder Co., Worcester, Mass., formerly Churchill-Morgan-Crittsinger, Inc., recently acquired by the Greenfield Tap & Die Corporation, Greenfield, Mass., will immediately be moved to the latter city, instead of waiting until fall, as originally planned.

Morris Automobile Radiator Mfg. Co., Worcester, Mass., has acquired property at 12 Harding street for the establishment of a new plant for the manufacture of automobile radiators and other metal products. Morris Septinuck heads the company.

L. G. Schoepflin & Co., Buffalo, automobile trucks, now temporarily located at Ellicott and Washington streets, has had plans prepared for a new two-story service and repair works at 306 Franklin street, estimated to cost about $60,000.

Barley Motor Car Co., Kalamazoo, Mich., which makes Roamer cars, has purchased the business and equipment of the Roamer Motor Car Corporation, San Francisco, Cal., for a branch factory.

Body Builders

Smith-Springfield Body Corp., at West Springfield, Mass., recently celebrated the opening of the second unit of a new plant that the company is building. The new structure, 100 by 380 feet, is equipped with machinery of the most modern type. Plans are understood to have been settled upon for work to begin immediately on a third.

Detroit Waterproof Body Co. was sold by the Security Trust Co. as receiver under an order of the Federal court to Hugh O'Connor, president of the Michigan Wire Cloth Co. O'Connor bid $14,000 for the property as a going concern and his offer will be submitted to Judge Tuttle for acceptance or rejection.

Mullins Body Corp., Salem, O., employes have returned to work on the company's terms, thereby ending a strike which began a few weeks ago. It is reported that business is confined largely to orders from the larger automobile manufacturers, and that the company is in good financial and physical condtion.

Every Purpose Truck Body Company's plant is being moved to Glenwood City from La Crosse, Wis. Work is well under way on the large factory building. It will be one of the largest and most modern truck body factories in the United States.

Chickasha Auto Top Co., Chickasha, Okla., operating an automobile top and equipment manufacturing plant at 114 Kansas avenue, has preliminary plans under way for the establishment of new works as an extension to the present factory.

Hudson Auto Body Co., Union Hill, N. J., has been incorporated with a capital of $100,000 by Joseph Solomon, Morris Bernstein and Carl Weitz, 8 Bergenline avenue, to manufacture automobile bodies and equipment.

American Motor Body Co., Glenwood avenue near Eighteenth street, Philadelphia, has filed plans for an addition. Improvements will also be made in the present works.

Max Leowitz's automobile body manufacturing plant at Roosevelt, N. J., sustained a fire loss on July 8, with loss estimated at about $20,000, including equipment.

Consolidated Wagon & Machine Co., Salt Lake City, Utah, is planning to rebuild the portion of its works destroyed by fire July 2, with loss estimated at $75,000.

Personal Mention

George H. Hannum, general manager of the Oakland Motor Car Division of the General Motors Corp., has been elected by that organization to fill the post of vice-president left vacant by the withdrawal of R. H. Collins, whose resignation has been accepted. Another appointment to a vice-presidency was made in the election of A. B. C. Hardy, general manager of the Olds Motors Works Division. Filling the post of director which Collins also formerly occupied is Fred J. Fisher, who has been identified with the activities of the Fisher Body interests which are known to be closely allied with General Motors.

Geo. T. Briggs is again connected with the Wheeler-Schebler Carburetor Co. as general sales manager Mr. Briggs was associated with the Sinclair Refining Co. as manager of the automotive division and more recently as general manager of the

F. R. Robinson, secretary of the Packard Motor Car Co., has assumed also the duties of treasurer. He has been in the Packard organization for the past twelve years, holding successively the positions of auditor, comptroller and secretary.

W. A. Brooks, treasurer of the Bearings Service Co., Detroit, has also been elected to fill the post of secretary of the corporation, occupying the position left vacant by the resignation of D H. Terry, which was to become effective July 1. The appointment has likewise been announced of K. H. MacQueen as assistant to the general manager of the organization.

John H Higgins, up to within a short time general manager of the Stewart Wire Wheel Co., Frankfort, Ind., has been made secretary and treasurer of the W.H.S. Manufacturing Co., of Indianapolis, maker of the Durabilt spark plug. In his new connection Higgins will be in charge of the company's sales and all matters pertaining to advertising.

D. F Hulgrave has been appointed manager of purchases for the Cadilac Motor Car Co., succeeding J. H. Main, who has been named director of the purchase section of the General Motors advisory board in Detroit. Hulgrave has been with the company for thirteen years, the latter three being assistant to Main.

Donald P. Hess, for nearly three years assistant works manager of the main plant of the Timken Roller Bearing Co., at Canton, O., has ben made general manager of the plant at Columbus. He succeeds C. N. Replogle, who has resigned.

Charles B. Shanks, widely and well known among all the old-timers, has become affiliated with the Anderson Motor Co., Rock Hill, S. C., in the capacity of vice-president, where he will have general supervision of sales and advertising.

C. J. Strobel, manager of the Marysville, Mich., plant of the Athol Manufacturing Co., was elected recently to the board and made a vice-president of the Marysville Chamber of Commerce for the fiscal year beginning with July 1.

Roy Davey, who has been representative and branch manager at Detroit for the American Bosch Magneto Corp., has been advanced to larger responsibilities at the factory as manager of the Manufacturing Trade Department.

Earl B. Spencer has been appointed production manager of the Leach Biltwell Motor Car Co., Los Angeles. He was formerly a plant engineer at the Pierce-Arrow factory and later assistant general superintendent.

W. E. Palmer, former secretary and treasurer of the Goodyear Tire & Rubber Co., and long active in the financial side of the tire business, was named late last week as trustee for the Marion Tire & Rubber Co.

J. A Callahan, vice-president in charge of production for the Martin-Parry Corp., has been made vice-president and general manager by the directors. Callahan's headquarters will be at the York, Pa., plant.

William Robert Wilson has been elected president of the Maxwell Motor Corp. He previously served in important executive capacities with the Studebaker Corporation and with Dodge Brothers.

Charles Henry, Jr., identified for the past fourteen years with the Ford Motor Co., has become connected with the Simplex Corp. of Chicago in the capacity of vice-president and general manager.

W B. Kelly, for 13 years works manager of the Oakland Motor Car Co., has resigned. He states that he has no definite plans for the future, but it is presumed he will join the Durant forces.

W. R. Milner, body engineer of the Cadillac Motor Car Co., has resigned that post to rejoin his former chief, R. H. Collins, in the Collins Motor Car Co.

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. LXIII, No. 5 | NEW YORK, AUGUST, 1921 | $2.00 Per Year Issued Monthly

Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City.
Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3, 1879.

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The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

Vol. LXIII NEW YORK, AUGUST, 1921 No. 5

Modern Upholstering for Motor Cars

Various Methods of Trimming Now in Use, Materials Employed, Plan of Handling Them, and Other Details—Removable Cushions

LIKE other components of the motor car, the materials and methods used in upholstering the bodies, although following along earlier lines, have been refined and improved in recent years. More than this, many special materials have been developed through quantity production that were not available to the earlier coach builders.

Considering the several styles of trimming now in vogue, it is intended on the following pages to discuss in a practical way these styles, showing in detail how the work proceeds, and the methods followed by qualified experienced trimmers.

Fig. 5. Method of stuffing the hair in to the nearly completed seat cushions.

The most simple form of car, and consequently the one needing the least upholstery and that of the most simple nature, is the runabout or roadster, seating two when the seats are of the individual form, or three when a full width cushion is provided.

This body can be trimmed in a number of styles, either pipes and half diamonds as in Fig. 1, straight pipes with buttons as in Fig. 2, straight pipes without buttons as in Fig. 3, or perfectly plain without pipes, as shown in the cushions of Fig. 4, and in Fig. 7.

A number of bodies are being done plain, these being confined more to the sporting or semi-sporting type, however, than to the staid family type of car. The French builders favor this style, and since the war the German builders have taken it up to a very great extent for sporting type bodies, in fact it is well night universal.

The doors are usually fitted with flush pockets with flaps, the designing of which lends itself somewhat to the taste of the workman. In the first place the flush pocket does not take up space in the doorway, when the door is open, and further the recess between the door trimming and the panel can be used to carry the several necessary articles in connection with motoring, such as maps, tools, spares, goggles, gloves, etc.

Most modern bodies are of the plain or flush sided type, and the roll over squab so much in vogue a few years ago has gone, let us hope, never to return. The materials required for a two-seater body, says E. Flatman, writing in Cooper's Vehicle Journal (London), are 1½ hides leather, 1 gross buttons, 3 yards sail canvas 50 inches wide, 1½ yards buckram canvas, 1¼ yards black duck, or if preferred black linen, 1 yard wadding, 1 yard common felt, 12 pounds of horse hair, 8-7 in. springs, 8-5 in. springs of about No. 12 gauge, 2 yards rubber for the floor boards and step boards, and a spring mattress of the required size for the cushion. It will be better

first to take in hand the squab with half diamonds and pipes, and it may be said that the most general plan is to have the quarters quite separate from the back, as this method makes for additional comfort by allowing free play to the springs in the corner of the body, and consequently more resiliency.

It is better to proceed by measuring the body for the canvases in the following way: two pieces for the quarters, one for the back, allowing them in each case to be a little larger; the quarters should be 1 in. all round, and the back 6 in. deeper and 2 in. on each end, fit them into the body, allowing about 1 in. for nailing to the seat board, then mark the quarters along the top and bottom and down the front pillar, and also the back along the top and bottom. On these lines the centre of back and the width of the back should be marked on the end; further cut out a piece of canvas for the cushion large enough to cover the top and carry over to the bottom, overlapping the bottom about 3 in.; mark round the cushion at the top edge.

After this operation the canvases will be ready for marking the position of the buttons, which should be done in the following way: first take the two quarters, lay out on the bench one on top of the other; it will be noticed that the top and bottom lines are wider apart

The Cushion

For the cushion, as squares are preferred by many, and this style giving a nice soft and full top, which does not so readily lose its shape, mark off the canvas into about 5 in. squares, leaving the back row to come as they will; usually these will be narrower between the last row of buttons and the back edge of cushion, which is not of particular moment, providing they are not too narrow, should the top divide out making the squares more than 5 in., add the little extra to the front row rather than make all the squares larger.

When marking out the leather, allow 1½ in. in fullness each way in each square, also allowing enough for the sides to go right over the borders and to sew into the bottom of the cushion. All pleats should be machine sewn, and the squabs nicely stuffed on the bench, first tacking the canvas on a wooden frame, sew up the ends of back squab and bind with a piece of leather or sew back on to the canvas.

The squabs can now be put into the body, the quarter squabs first, which should be finished off by completing the stuffing all round and secure, meanwhile cutting out the extra thickness inside each pleat where nailed so that the finish is smooth and even; next fix in the springs for the back.

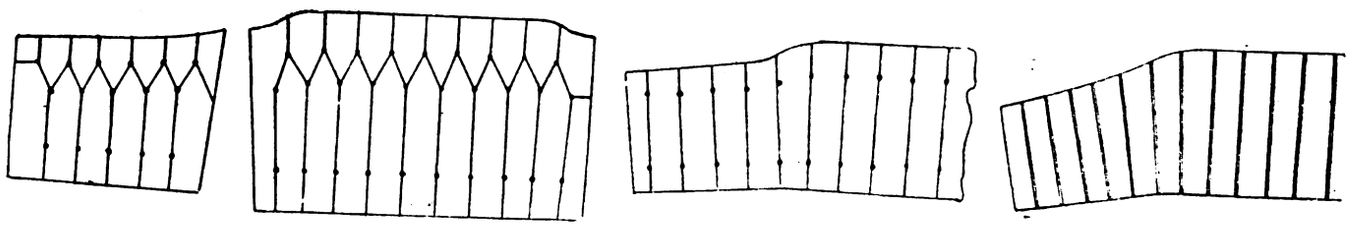

Fig. 1 (left). Squab with pipes and half diamonds. Fig. 2 (center). Squab with straight pipes and buttons. Fig. 3 (right). Straight pipes without buttons.

at the back than at the front, owing to the tilt of the seat. It is, therefore, a good plan if the bottom buttons are kept parallel with the bottom line, and the top buttons with the top line.

Then proceed to mark out for buttons, the half diamonds and pipes generally 3¾ in. wide and 4 in. deep between the top and bottom of the half diamonds. Next take the back canvas, add 1½ in. to the depth between the top and bottom lines to allow for the springs, also add 1½ in. at each end at the top button line for contraction when stuffed; mark out for buttons with pipes 4 in. wide and half diamonds 4¾ in. deep.

When this has been done, proceed by cutting out the leather and mark off for the buttons on the back of the hide; for the quarters fullness should be allowed, 1 in. across the pipes, ¼ in. between top and bottom of half diamonds, ⅜ in. between bottom of half diamonds and bottom buttons; allow ¾ in. at the bottom, and 1½ in. at the top, and 1½ in. at the front for stuffing up and nailing in; the fullness thus allowed will make up a nice squab that will not take up too much room in the width of the body.

For the back squab allow 1½ in. across the pipes, ¼ in. between top and bottom of half diamonds, 1 in. between bottom of half diamonds and bottom buttons, allow enough for the ends to stuff up full and level, with the rest of the squab also 2½ in. at the top, and strain at the bottom for nailing in.

These are sewn into a piece of sail canvas nailed into the body, the 7 in. springs in the centre of the swell of the squab, and 5 in. ones at the half diamonds; cover these with a piece of hessian canvas and sew each spring into its place, keeping each spring fair and true, then fix in the back squab, keeping the centre marks on the canvas in the centre of the body; stuff up the top nice and full, keeping all the pleats regular and even, and cutting out all extra thickness inside pleats where nailed.

If polished mouldings are used to cover the edges, a rebate must be made on the top rail, the same depth as the thickness of leather to allow the moulding to set level and even. Cover the seat board, and cover and fix valance plate. This will complete the body.

The Doors

For the doors, make up a pocket and flap. Sometimes the levers of handles at the off side of door prevent the effective use of a flap; in such a case, paste up a piece of leather with ornaments to match the flap of the near side door, and when dry, machine sew round the ornament and fix on to the door, either recessed, that is pasted on the inside of the panel, or kept flush with the framework, according to the space allowed by the levers.

To proceed with the near side door, line the door with black linen, first pasting a piece of common felt on the inside of the metal panel; this helps to prevent tools and spares from making bumps in the panel, and at the same time keeps them from clattering against the panel when the vehicle is in motion.

Make up the flap on a piece of buckram canvas of the required size and design, line up the back with black linen, and fix a nicely designed ornament; then paste on the leather, rub in all round the ornament with a bone sleeker; and when dry close welt all round the edge. An excellent method of making the pocket will be thus: cut a piece of leather and black linen the same size and shape as the door, place face to face, mark out a space 4 in. deep and 7 in. wide and about 3 in. down from the top, round off the bottom corners and machine sew round the lines thus made; cut out the material inside the sewing, being certain to make a neat job of this. then do what stuffing is to be done, insert a metal bottom if one is to be used, if not complete the stuffing and sew the combined leather and cloth with the bottom felt in position, and finish it off with a covering of black linen, sewn all around.

Another Style of Trimming

Let us next consider the procedure of trimming a body with straight pipes and buttons as Fig. 2. The method is a little different, and for quantities of materials, only 1¼ hides of leather and 10 lbs. of hair will be needed, also ¾ yard of buckram canvas, other quantities being the same.

In this case the squab and quarters are made in one, although if preferred they can be put in separately; the cushion is also made with straight pipes. To proceed put the springs in first, then fit a piece of canvas in the body for the squab. marking round top, bottom and down the front pillars, also centre, top and bottom, and an upright line in each corner; this is for a guide to get the corners set out upright; take out and lay out on the bench folding at the centre, particularly seeing that the lines of each half come uniformly together.

Now space off for the buttons, marking a line parallel with and 4½ in. up from the bottom line; draw another line parallel with the top line 4½ in. down on the quarter, and 5½ in. down on the back, join up this line in the corner uniform with the sweep of the top line, divide these lines up for pipes of 4 in. wide, not more; if 4 in. does not divide well, reduce the width of pipes a little, or put half a pipe on either side of the centre line at the corners, taper the pipes at the bottom to suit the corner, being guided by the upright lines, marked when fitting the canvas, to keep these corner pipes upright and true; when marking out the cushion, see that the pipes follow at the back part of the squab as far as possible, marking the buttons 5 in. from the front edge of the cushion and 4 in. from the back edge.

When cutting out the leather for the squab, allow 1¼ in. fullness across the pipes, but only allow ¾ in. in two of the pipes in each corner; allow ¾ in. fullness between top and bottom buttons for the swell in the back, gradually reducing this in the corners of quarters to nothing; cut out in separate pieces the back and quarters and one piece for each corner consisting of one or two pipes, leaving extra leather above the top button at each join, machine sewing this, and also all pleats.

When cutting the leather for cushion, allow 1¼ in. across the pipes, nothing between the back and front buttons; the cushion in other respects is made up in the same way as previously explained.

Another Style

Another pattern of squab for a cheap job is with straight pipes without buttons, as Fig. 3. To carry this out the squab should be made up in two halves; mark out in pipes as already described, but do not allow any fullness in the swell; then machine sew each pleat on its corresponding line on the canvas, beginning with the front pleat of each quarter and working towards the centre; when each half has been so treated, join up the centre and stuff. The cushion is made in the same way, then half the pleats will turn left and half right.

For the door of either of these bodies, make up the pocket on buckram canvas backed with black linen, cut out a hole in the buckram the same size as previous door, and paste on the leather, turning the leather over the edge of the buckram, and sewing it neatly all around the

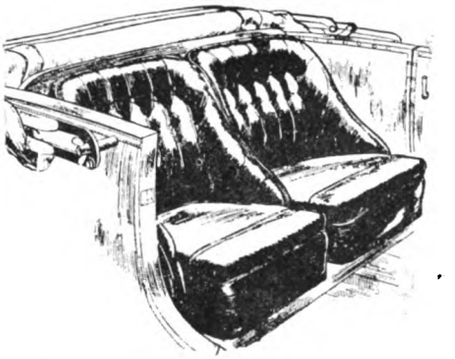

Fig. 4. Popular roadster upholstering with pipes and half diamonds for back, perfectly plain cushions with cross seam.

opening, or else fastening it down with a close welt. As was done for the pockets mentioned previously, the metal bottom should be inserted if one is used, but if not, felt should be cut to fit the bottom.

Trimming the Touring Body

Next to the runabout in simplicity, although of greater importance because of the greater proportion built, comes the open touring car, of the flush sided type. Many of these are finished by pulling up the top edges of the squabs and nailing them on the top rail, with a polished moulding or beading used to finish this top line. This method is used in the job shown partly completed in Fig 6. When this is done the beading is frequently covered with leather to match the squabs.

Where metal panels are used and rolled over the rail the squabs are fixed under the rail and finished with an edging of piping. The style of the squabs may be described as half diamonds and pipes as Fig. 1.

The cushions are made with squares and the doors are treated as explained in the previous article.

Materials

The materials required for a body of this description are: 3 hides of leather, 1½ gross buttons, 16-7 in. No. 12 springs, 16-5 in. No. 12 springs, 5 yards sail canvas, double width, ½ yard buckram canvas, 2½ yards hessian canvas, 4 yards black linen, 48 in. wide, 35 lbs. hair, 3 yards carpet, 2 yards common felt, 4 carpet knobs, 4 eyelets for same, 6 door stop plates and screws, 2 spring mattresses, 2 yards wadding, 2¼ yards lin-rubber, 1 ball twine, seaming cord, etc.

Previous to putting in the springs, it is advisable to fix boards 5 in. wide and ½ in. thick to the battens of the

body, and fix the springs to these; this method is much stronger than webbings, besides keeping the springs well forward and allowing them full play in the swell of the squab. As a precaution against the springs rattling, a strip of felt should be fixed on each board, the springs being secured with strips of leather; they are then covered with hessian canvas and each spring is sewn into place.

After this preliminary operation fit the canvas for the squabs, cutting out a piece of canvas for each squab to rough size, and marking same all round the top, bottom, and down the front pillars; mark an upright line in each corner, taking care to find the centre of each

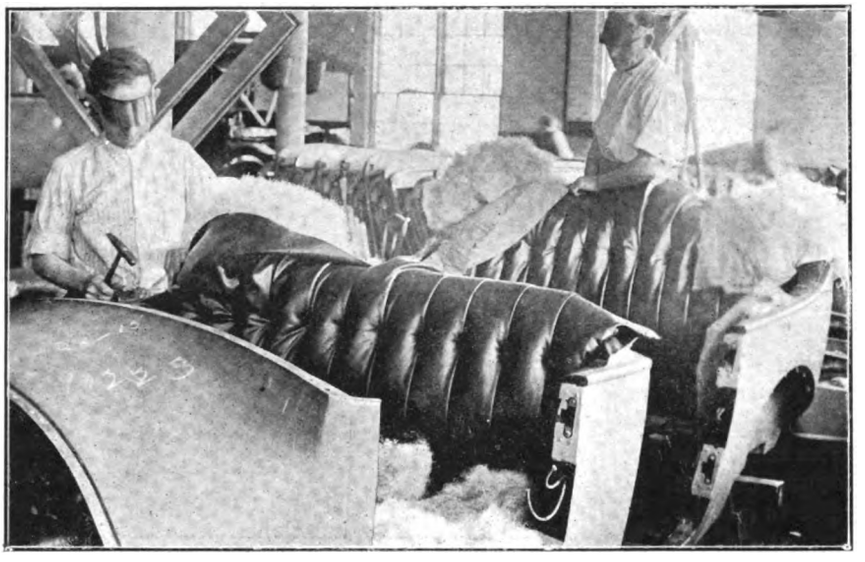

Fig. 6. Finishing the straight pipe and buttons squab on the touring car framework.

squab by measurement, then strike an upright line at ths point, and mark on the body where this line comes at top and bottom. With these lines properly set out, the canvas may be laid out on the bench and set out for half diamonds and pipes as Fig. 1. This done, mark out the buttons, the bottom row 4½ in. up. the top row 5½ in. from the top rail; the half diamonds should be 4½ in. deep, and the pipes about 4 in. wide, using the three upright lines as a guide to keep the pipes perpendicular.

In many of the fashionable types of bodies there is not much rise at the shoulder in the quarters, therefore no difficulty will be found in carrying half diamonds round the corners, includng the quarters; either a top pleat or a pipe pleat must come on the centre line of the two, using the one that works out best.

Cutting Out the Leather

We can then proceed to cut out the leather; each squab should be cut out in five pieces, two quarters, two corners and one back piece. It is necessary to allow for fullness in the quarters, also 1 in. across the pipes, ⅜ in. in the depth of the half diamond, and nothing between the half diamond and bottom button; usually owing to the wheel arch of the body, the hind quarters have no buttons, the pleats being pulled down to the seat with very little, if any, stuffing at this particular part; for the back piece allow 1½ in. across the pipes, ⅜ in. in the half diamond and 1 in. between bottom of the half diamond and bottom buttons, allowing only 1¼ in. across each end pipe.

Cut the corner pieces with either one or two pipes, whichever will suit the corner best, allowing ¾ in. across the pipes in these, and in the whole corner graduate the fullness between the half diamonds and bottom button from 1 in. to nothing where it joins up with the quarters; extra leather should be left on at the joins above the top buttons in order to make the pleats properly, all of which are joined and machine sewn.

The Process of Stuffing

As an assistance in the process of stuffing the squabs, it is necessary to stretch and nail the canvas to a frame, and first put in the bottom row of buttons, then pile up hair on the canvas and pull over the leather and put in the top row of buttons; lastly put in the centre row and regulate the hair with a stuffing iron, after which the squabs are ready to fix, care being taken that all lines and marks on the canvas are nailed to their respective places, which is the most important point to remember in putting in a round corner squab; the hair in the pipes should be well regulated. The squab can then be nailed down all around the bottom; after this is done stuff up the half diamonds and top and securing them at each pleat, then regulate the top and finish off with gimp pins, cutting the leather out at each pleat to leave all flush and even, for either polished mouldings or beading.

The bottom of the hind part of the body should be lined with carpet, the rockers, heelboard, and bottom part at the back of the front seat being covered with similar material. When polished wood compartments are fitted a certain distance from the floor, the carpet will be fitted up to the compartments, but if no compartments are fitted then 9 in. will be a sufficient depth of carpet, and just enough to prevent the toes of passengers marking the front panel; a bottom carpet must also be fitted, fixed with carpet knobs and eyelets.

It is customary to bind all carpets with either pasting lace or leather to match the body trimming. The doors may be treated in either of the methods explained previously where also the method of making the cushion was fully dealt with.

It now only remains to make and fix the door stops and cover the front boards and step boards with lin-rubber to complete the job.

The Straight Pipe Style

This type of body may also be trimmed in the style of straight pipes with piping in the seams as Fig. 3.

The method of procedure is slightly altered and the springs should be put in first, covering the same with hessian canvas and sewing each spring in place as usual, then make a number of long stitches with twine all over the hessian canvas, and place on a layer of hair, using the long loops of the stitches to keep it in place; cover the whole with calico and nailing same on the face of the top rail near the top edge.

Next take a canvas pattern of the half of each seat, lay these patterns out on the bench and mark out for straight pipes in the usual way, marking also a line

all round the top rail; this pattern is used as a guide for the cutting out of the squabs. Each pipe should have a separate piece of canvas, and the pipes should be stamped out in pairs from the pattern. In order to make up the two halves of the squab, allow ¼ in. on each side of the pipes on each piece of canvas for making up; number each pipe from the front of each squab, near and off, to avoid getting them mixed, and mark on each pipe the bottom and top lines, also the line 3 in. down. When making up the squab each join is left unsewn above this last line in order to enable the top of the squab to be more easily worked and finished off level.

In cutting out the leather the same pattern may be used, for fullness allowing across each pipe ¼ in. at the bottom, 1 in. at the centre of the pipe and ¼ in. at the line marked 3 in. down from the top, also add ¼ in. on each side all the way up for making up the seam; mark on the leather the bottom line and also the line 3 in. from the top rail, also be careful to allow enough leather on either side of the pipe above the 3 in. line, so that each succeeding pleat will lay firmly over the leather from the preceding pipe.

Care should be taken to number each pipe the same as the canvas, and piping made up to suit the job should be in readiness; then join up all the seams, putting a length of piping in each seam. Make up each squab a half at a time, being very careful to keep all marking points accurate, then machine sew, after which join up the middle seam of each squab. The piping should be made up with thin string, seaming cord or piping cane being too thick; the proper thickness is about twice the thickness of ordinary twine.

Preparatory to stuffing. the squabs should be mailed out on the bench; filled up nice and even with hair, but not to make them too hard, then fixed in the body; when finishing off along the top, recesses should be cut in the wood work to enable the leather and pipe at each seam to lay in flat and finish off level for the beading or polished mouldings.

Cushions and Doors

The cushions for this style of trimming are equally plain, with a roll along the front part of the top, with borders all round. The doors can be trimmed with

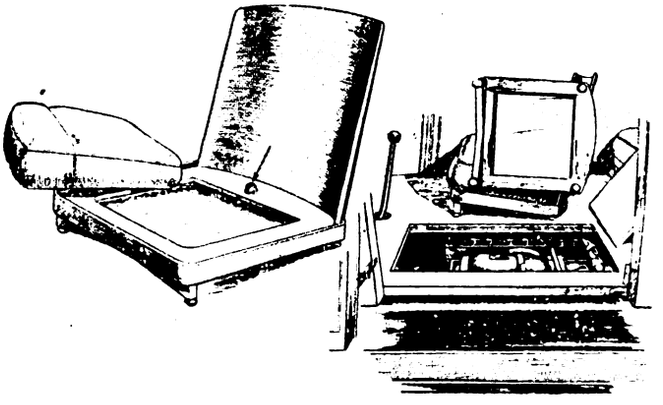

Fig. 7. Movable seats of simple construction, and removable seat and back cushions of plain upholstering mark a new English light car.

pockets as previously described, but sometimes when this can not be done, space can be found for small pockets at the front part of the hind quarters.

To prepare this door squab, strips of canvas of the required width should be cut out for the pipes, and in cutting the leather, allow ¾ in. fullness across the pipes, carrying this fullness almost to the top and bottom, when the fullness is reduced to ¼ in. at these places to prevent a surplus of leather, which would otherwise fold over the piping and spoil the appearance; also allow ¼ in. on each side on both leather and canvas for the seams. A door trimmed in this style looks best with carpet fixed on the bottom part to a depth of 7 or 8 in.

The foregoing fairly covers the method used for squabs for present day styles, and a study of these methods will give a young trimmer a good ground to build up knowledge with regard to this particular item. In the case of doors and general finish, these things are more easily copied, but with squabs there is only one way and that is the right way, and it is of great value to a workman to know how to manipulate fullnesses, the most important point of all being to work accurately to all markings and lines.

An excellent finish for the doors and pillars of open cars and front seats of the larger bodies is a combined piping and banding made in the following manner: Cut out strips of leather 2¼ in. wide, join them all up in one long length, made by skiving the ends of each strip neatly, and securing with rubber solution; next skive off the colored surface of the leather, showing a margin of ¼ in. along the edge, solution along one side of the strip on the back of the leather, and turn in a little more than ¼ in. and stick down; make the other edge into a piping by running through on the sewing machine. Also run a row of machining along the turned-in edge and another row ⅜ in. from the edge. When fixing this piping and banding on the job, tack along close to the piping, use solution all inside the banding, and when tacky press down. all corners being mitred and fix with two small-headed gimp pins; this when done neatly, will make a very clean finish.

Later, some phases of closed car upholstering and trimming will be described and illustrated.

Door-Fit Clearances

The passenger-car body division of the S. A. E. has tentatively recommended the following door-fit clearances:

Clearance, hinge side, ⅛ in.; lock side, 3-16 in.; bottom, 7-32 in.; top, ⅛ in.; jamb, 3-16 in.; bead. 3-32 in.

These clearances are for all types of bodies and are measured from wood-to-wood or metal-to-metal before painting. The top clearance does not apply to open bodies. These standard clearances, if adopted will be of great assistance to passenger car body engineers.

Door-Handle Squares

The committee has also tentatively recommended that door handle squares shall be made from 5-16 in. cold-drawn key stock with tolerances of plus or minus 0.001 in. There has, however, been some criticism as to these tolerances, it being stated by some manufacturers that they are too close and that steel cannot be obtained on the market within these limits.

It is considered, however. that for real workmanship these tolerances should be adhered to and it is known that certain well-known automobile companies have obtained key stock to this specification for several years.

Substitutes for Ash in Automobile Body Construction

IN AUTOMOBILE body construction, ash has always been considered the most desirable wood, because it combines moderate weight, great toughness, easy workability and comparative freedom from warping. No other wood presents all these or corresponding advantages without disadvantages which more than overbalance. Unfortunately, high grade ash has been and still is, high in price, and for this reason, other woods are gradually replacing it except on the most expensive bodies.

Under such circumstances, it is important to the body builders to know what the advantages and disadvantages of the various possible substitutes are. The following description prepared by the forest products laboratory gives some of the advantages and disadvantages of the substitute woods as compared with forest grown ash for automobile construction:

Maple.—Hard maple is used for sills in many cars, and in some for the framework of the body and even the floor and running boards. Maple is fully as strong and stiff as a beam or post as white ash, but it is not as shock-resistant. It is usually cheaper than ash and runs more uniform in strength. Maple warps very little, in this respect being superior to elm. On the other hand, maple is more difficult to season without checking than ash or elm, and it is said not to hold screws so well in motor car bodies. On account of the smooth, fine texture of maple, paint and enamel rub off it more easily, especially on carved surfaces which receive considerable wear, than off birch, which is slightly more porous. Because of its smooth-wearing qualities and comparative freedom from slivers, maple is preferred to all other woods for the floors of delivery trucks.

Elm.—The principal use of elm is for frames, seat backs and doors; very little, if any, is used for sills. White elm is preferred to rock elm, except for some of the bent parts, because it is more easily worked and is less subject to warping. For the same reasons lumber from old white elm trees, usually called "gray elm," is preferred to that from younger or vigorously growing trees. Old white elm is not so strong or tough as ash, on the average, but it varies less in strength than ash, especially that which comes from the southern swamps.

Birch.—Yellow birch is a close rival of maple. It is used for sills, framework and many minor parts. It is said to hold the paint better than maple on exposed parts.

Hickory.—The true hickories are used almost exclusively for spokes and felloes. The pecan hickories, which are somewhat inferior as a class to the true hickories, might be used in body constructon, although their hardness and tendency to twist would perhaps prove a serious drawback.

Red Gum.—Red gum is too weak and soft for the sills and other major parts of the frame, but is used for floor boards, seat risers and other minor parts. One of the principal drawbacks to the use of gum is its tendency to warp with changes in moisture content. Quarter-sawed gum gives less trouble in warping than plain-sawed gum.

Oak.—In automobile construction no distinction is made, as a rule, between the different species of oak or even between the red oak and white oak groups. In truck bodies, oak is one of the leading woods, being used for sills, cross sills, frames, floors and stakes. In pleasure cars oak is rarely used for the frame or sills. Wormy oak is used for running boards, floor boards and seats and some sound oak for instrument boards and battery boxes. Top bows are made almost exclusively of oak, second growth being preferred.

Southern Yellow Pine.—Under this heading are included longleaf, loblolly, shortleaf and some of the minor southern pines. These have been found adaptable for running boards, floor boards, seat boards and a number of small parts in the seats and frames.

Other Species.—Cottonwood is used for dash boards of pleasure cars and the boxes or bodies of trucks. Sycamore, beech, basswood, yellow poplar, cucumber, tupelo, gum, chestnut, Douglas fir and western yellow pine have also entered into car body construction to a small extent.

The comparative merits of the different species in the four properties most important in automobile construction are given in the following table, the strength of forest-grown white ash being taken as 100. Actual strength values of these species are to be found in department of agricultural bulletin 556, "Mechanical Properties of Woods Grown in the United States."

Strength of Woods Used in Automobile Construction in Percent of the Strength of Forest Grown White Ash

Species	Strength as a beam or post	Stiffness	Shock resisting ability	Hardness
Hardwoods—				
Ash, white, forest grown.	100.0	100.0	100.0	100.0
Ash, black	71.3	79.3	90.1	62.3
Ash, white, second growth.	122.5	117.6	119.6	118.9
Basswood	59.1	80.6	40.5	29.6
Beech	93.5	96.9	96.0	90.0
Birch, yellow	104.8	116.8	120.6	80.9
Chestnut	66.0	71.9	53.4	49.2
Cottonwood	60.6	79.0	54.3	35.3
Cucumber	85.4	112.4	76.7	54.9
Elm, rock or cork.....	98.8	92.9	140.5	101.6
Elm, white	79.2	79.5	89.5	57.1
Gum, red	80.7	91.5	75.5	59.0
Gum, tupelo or cotton....	81.4	82.5	63.5	77.3
Hickories, pecan	103.5	103.8	119.7	139.6
Hickories, true	126.6	120.2	173.9	150.4
Maple, red	90.0	101.2	78.7	75.4
Maple, silver	66.9	68.5	71.7	64.3
Maple, sugar	104.7	105.9	90.5	103.0
Oaks, all kinds	92.6	101.3	94.9	104.5
Poplar, yellow	67.3	93.8	41.5	37.9
Conifers—				
Fir, Douglas, Pac. coast..	95.7	122.1	59.9	58.3
Pine, loblolly	93.7	105.6	71.0	60.0
Pine, longleaf	112.2	122.1	77.7	74.8
Pine, shortleaf	94.1	100.6	69.7	64.0
Pine, western white.....	75.5	99.7	53.8	37.0
Pine, western yellow	67.0	75.6	42.9	41.0
Spruce, sitka	69.5	94.1	63.3	44.9

American Practice in Japanning for Automobiles

By W. A. DARRAH *

Details of the Important Parts of the Japanning Process, Now so Widely Used for Motor Car Parts—Agitation Necessary—Provision for Uniformity—Heating

THE japanning operation is one of the most important from the standpoint of finish and appearance, but it is one of the few operations which the average automobile manufacturer still carries out on a rule-of-thumb basis, trusting to traditions that the result will be satisfactory. Possibly the combination of chemical engineering, heat application and mechanical problems, has caused this condition. With the thought that an analysis of japanning practice as a systematized industrial operation may work to the improvement of the commercial product, the investigation described herein was made.

Nature of Japans

The lack of definite knowledge regarding japanning practice frequently begins with the manufacturer. In spite of the fact that excellent finishes are now available, some are following formulas which are more than a generation old. The average commercial japan usually comprises the following ingredients: Linseed or other oxidizing oil, gums or pitches, drier, color, solvent.

Fundamentally the average japan consists of a drying oil which forms most of the body and serves as a medium to impart flexibility to the finished coating. Linseed oil is most commonly used for this purpose although other drying oils may be employed with the proper precaution. The basic cost is controlled by the quantity of linseed oil employed; the durability and protection are also dependent upon the amount and grade of this ingredient. The presence of an excess of linseed oil has a tendency to make the finish less brilliant than normal, but gives a thicker coat and greater durability; the surface is also somewhat softer and loses its polish more readily, although the protection to the metal is good. On the other hand too little linseed oil is usually compensated for by the addition of more gums or pitches, in which case the tendency of the japan is to be rather hard and brittle; but the finish is very brilliant. Therefore the cheaper finishes are likely to be more brilliant than the higher grade products, but the coating is thin and cracks off with comparative ease, and the protection to the metal beneath is imperfect.

In some cases rubber has been substituted for linseed oil in certain japans, particularly those employed for the first or priming coat. Rubber acts in the same manner as oil but does not give the smooth finish. The function of the oil or rubber is to act as a flexible binder and supply the protection to the metal surface, while the gums and pitches serve to give hardness and brilliance to the finish.

Most baking enamels are black or very dark colored on account of the difficulty of applying and baking a light-colored enamel quickly. Even under the most careful handling the light colored finishes have a decided tendency to turn yellow or brown. Fading is a common occurrence with most colored baking japans, and the final result is generally unsatisfactory. Carbon black is employed with excellent results in the priming coat of many of the black japans. Aside from the relatively small use of black pitches or gums, carbon black is the most used coloring material.

Driers are frequently added to commercial japans but this practice is not to be entirely recommended. The nature and amount of drier employed are of fundamental importance, as any substance which may be subsequently attacked by moisture and air must be avoided. The organic driers are probably the least harmful. It should be noted that the conditions under which japans are usually baked are such as to reduce materially the necessity for a drier. The solvent generally employed is either benzine or solvent naphtha. Benzine is preferred although both materials merely act as a thinning medium and permit the mechanical application of the japan with greater uniformity and with minimum labor. The solvents are entirely removed in the drying and baking operation, and it appears that they do not combine in any way with the materials of the japan. As a rule commercial japans carry about 50 percent by volume of solvent. It is not unusual to add 15 to 30 percent solvent at the enamelling plant to facilitate handling and application. The exact viscosity of a japan can be controlled absolutely by the amount of solvent, assuming that measurements are made at a constant temperature, and this is a point of vital importance from the standpoint of securing a uniform product.

A trial application and a test of the resulting enameled surface is a successful and reasonable basis for selecting japans, but it should be kept in mind that the means of application and conditions of baking have an extremely important bearing upon the appearance and durability of the product; an excellent japan may give inferior results when not handled in the best manner. Competitive conditions are such that the price which the consumer wishes to pay is determined, and a japan representing the best grade available for that price is submitted. The ingredient which has the most influence in determining the selling price and quality is linseed oil. In many cases the higher quality japans contain more expensive gums, while the cheaper japans may contain even shellac and stearine pitch.

To decide intelligently upon the best grade of japan and the best method of applying and handling the material a brief consideration of the function of japan is desirable. The original and primary objects of applying a finish to the metal parts were to protect them from excessive deterioration and supply a pleasing appearance to the finished article. To realize these conditions in practice the japan must be weatherproof, somewhat flexible, sufficiently thick to be lasting, have sufficient hard-

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ness to prevent excessive scratching under ordinary service conditions and take on a brilliant finish.

A fundamental requirement of any plant using large quantities of japan is adequate provision for securing a uniform product. As a rule the japan manufacturer is able to supply a uniform product initially, so that the user can confine his attention, aside from the ordinary inspection laboratory tests on purchasing, to the equipment designed to maintain the product constant throughout his own operations. Most systems, whether they be of the dipping, spraying or flowing type, will require large storage capacity for mixed japan, that is japan plus solvent, and also adequate tankage for mixing the material in use with additional solvent to maintain the viscosity standard. It is very desirable to maintain a uniform temperature throughout the rooms where the japan is handled or mixed. Uniformity is the essential feature, but the best results appear to be secured when the temperatures range from 80 to 100 deg. F. Obviously the higher the temperature of the japan the smaller amount of solvent required to secure a given viscosity. On the other hand if the temperatures of the room and the japan are too high the solvent has more tendency to evaporate.

Another consideration of prime importance is to agitate the japan in all parts of the system continually. Even the highest grade product has a decided tendency to deposit some of the heavier ingredients after standing. One means of reducing the trouble from this cause is to avoid the presence of pockets or undrained pools of japan in any part of the piping or tankage system. Entering pipes should end near the top of the tanks and exit pipes should be connected to the lowest portion. All tanks should be covered wherever feasible, and expose a minimum surface to the atmosphere in case it is impracticable to cover them.

Japan is usually applied in one of three ways. Small articles can be dipped directly in the tank of flowing japan and after a period of dripping can be carried by conveyors into the baking oven. Large surfaces which cannot be conveniently dipped can be coated by flowing. In this case the japan is pumped through a hose and out of an elongated slotted nozzle, in such a manner that it flows smoothly and regularly over a considerable surface. The method of application when properly handled results in an excellent finish. A third method, also used for applying paints, consists in spraying the coating material by a stream of compressed air. This method when properly employed produces good results and also permits some control of the thickness of the coat. The application of japan by spraying is however attended by serious personal inconvenience, due to the unpleasant vapors which result. Some attempts have been made to produce an automatic spray or mist so arranged that the article to be treated passes through a closed chamber on a conveyor and under these conditions is entirely coated with paint or japan. Control of the speed of travel of the part to be coated offers a rough means of controlling the thickness of the coat.

The amount of japan which adheres to a freshly coated surface is naturally a variable, depending upon the viscosity of the japan, the condition of the surface and some other factors. It is therefore impossible to make a general statement which will cover all cases, but some instances resulting from actual experience may be helpful. For example, in enameling such materials as front guards, mud aprons, runabout shields and tanks, actual practice indicated a consumption of 1 lb. of liquid japan to each 50 lb. of sheet metal enameled. The metal in this case was naturally a variable ranging from 12 to 18 gage. In another case, in which japan is applied by flowing to one side of the surface only, an average of about 1 lb. of japan to 180 lbs. of metal is employed. Here the average thickness of the entire surface averaged about 14 gage metal. As an average, it would seem that about 25 sq. ft. of surface can be covered by 1 lb. of japan in one coat, although, as already pointed out, this quantity is so closely related to innumerable variables that only an approximate estimate can be made. In case a primer coat is applied to the metal, average practice indicates that about 30 percent additional weight of japan will be required. In other words, because of the numerous crevices which must be filled, the first or priming coat requires an average of about 1.3 lb. of japan for each 25 sq. ft.

The weight of wet or liquid japan, which adheres to 25 sq. ft. of surface, will approach 3 pounds. After dripping, the loss in weight by this operation will average about 1.75 lb., while the remainder of the loss in weight results from the evaporation of the solvents during the drying operation. In case the primer coat is sanded before the application of the finish coat, the weight of dry japan removed is about 0.5 lb. per 25 sq. ft. of surface. As a rule spraying japan weighs about 7 lbs. per gal. From the data and information given above it is possible to calculate accurately the quantity of japan required for a given production and the data, in connection with the figures given for the circulation required, will permit fairly accurate design of the japan-handling equipment. The speeds allowable for the travel of japan through pipes and conduits should somewhat exceed the safe speeds for the flow of oil.

The explosive nature of a mixture of air and the solvent used in japan necessitates a careful study of the air circulation system, wherever japan is employed. As a rule the danger limits lie between 2.4 and 6.1 percent of the weight of the solvent in pounds. In other words, a mixture of 100 lbs. of air and 3 lbs. of evaporated solvent is extremely dangerous. It is good practice to maintain the maximum concentration of benzine solvent in air at less than 1 percent by weight, as under these conditions explosions are practically impossible. The basis given of calculating the necessary amount of air circulation is in my opinion much more logical than the empirical method frequently employed of assuming either a given number of changes of air per hour or a given number of cubic feet of air per pound of material japanned. The misleading results which the latter method may involve will be clear when a comparison is made on this basis of the air circulation required for japanning engine flywheels and automobile fenders.

Cleaning the Metal and Baking Japan

It is good practice to thoroughly clean the metal surface before applying the japan coating. While this subject should logically precede the discussion of the application of japan, it seems better to include it at this point. Two methods are used in practice to remove the oil and grease. One consists in washing the surface with some solvent.

The second method consists in burning off the oils and grease in a hot oven. It has been found that a 15-min. exposure to a temperature of about 500 deg. F., in the presence of an excess of air, will entirely remove the oily materials without in any way adversely affecting the surface. Naturally the condition of the surface, the weight of metal to be treated and many other factors will affect this operation. The data given are based upon sheet metal surfaces averaging about 14 gage. In this case the amount of oils and grease removed averages about 0.3 lb. per 25 sq. ft. of surface. The amount of air employed for circulation under these conditions can be determined upon substantially the same basis as that employed in japanning practice. In other words the concentration of vaporized oils should not exceed 1 percent by weight of the air employed.

Aside from the matter of compounding the japan, no single factor is so important as the baking process. There are many factors which require careful control to secure a durable, hard, elastic finish, having good appearance. Some of the more important of these are time of baking, temperature of baking, temperature gradient, uniformity of temperature and air condition in the oven.

After the article to be japanned has been dipped in japan, the excess of liquid gradually flows from the surface by dripping until a fairly uniform condition has been secured. While in this state the article enters the japanning oven and its temperature is gradually increased. The first effect of the increased temperature is to soften the layer of japan somewhat because the heat has a tendency to lower the viscosity. In case there are any pores in the coating, this action allows them to be filled up. It also results in reducing the thickness of the coat, with the natural consequence that its durability is somewhat reduced. The softening of the surface layer is immediately followed by the evaporation of a portion of the solvent, which in turn tends to harden the japan coating. This action continues throughout the baking period until the solvent is completely removed. At the same time the linseed oil undergoes a process of polymerization and oxidation, similar to the action in drying paints and varnishes. The presence of a large excess of air is of material assistance in hastening the oxidation process as well as in removing the benzine vapors, and thus hastens the evaporation of the solvent. As the temperature continues to increase, the gums and resins begin to liquify and then to give up certain more volatile constituents in the course of forming a hard condensation product. This is usually the last stage in the hardening of the japan.

It will be evident that the resultant product will have a surface finish depending upon the relative temperature of the japan and the surrounding air. In other words if the japan and the metal surface upon which it is spread are warmer than the air about it, the polymerization of the oil and the hardening of the gums will take place more or less uniformly throughout the mass, at the same time that the evaporation of the solvent is occurring. Under these conditions the surface will be relatively free from microscopic pits which are sometimes noticed in poorly handled japan. On the other hand if the air surrounding the article is warmer than the metal and japan itself, the surface of the japan will tend to solidify before the interior and even before all of the solvent has been evaporated from the japan layer. One result of this condition is the formation of tiny pores or holes, caused by the evaporating solvent forcing its way through the outer layer or skin. These pores may be microscopic in size but serve as a weak point at which the japan may be attacked by the weather. The pores may also accumulate dust and dirt, thus causing unsatisfactory appearance after short service.

It is thus seen that a means of heating the articles to be japanned which permits keeping them slightly warmer than the surrounding air is desirable. To wholly obtain such a condition appears to be impracticable for ordinary work, but it can be approximated by supplying as much heat as possible by radiation from hot bodies. In other words the heating of a japanning oven exclusively by hot air is not as satisfactory as heating it by radiating surfaces. The most practical compromise, considering both the quality of the product and the cost of operating the oven, lies in supplying by radiation the heat necessary to raise the temperature of the metal and the japan to the desired point, and at the same time heating the entering air to approximately the temperature of the oven. Generally speaking, the lower the maximum temperature employed in baking the japan the better will be the resultant surface. It will be evident that a reduction in oven temperatures means an inccrease in the baking time, which in turn means either a materially larger investment in oven equipment or a corresponding reduced production.

Japan manufacturers urge the lowest possible baking temperature and the longest possible time, speaking from the standpoint of securing a durable and generally satisfactory finish. On the other hand because of the ever increasing production demands, the tendency has been to increase the temperature and decrease the baking time. Practice is widely variable in this connection. Excellent results are secured with baking temperatures of from 450 to 475 deg. F. In some cases temperatures of from 350 to 400 deg. are employed. A temperature of 450 deg. requires a baking period of about 45 min. to secure the best results, although in some cases baking may be completed in a 30-min. period. Temperatures of from 350 to 400 deg. F. require a baking time ranging from 4 to 2 hrs. to secure the best results, although this may be materially decreased under some conditions. The possibilities which arise in connection with a quick setting japan are very attractive, and some surprising results have been secured. I have given consideration to japans in which the solvent is water, and the field here disclosed is very large.

Extensive tests, as well as theoretical considerations, indicate that the resultant surface will be improved if the baking temperature is increased very gradually. The theoretical basis for this condition follows from the fact that the solvent will be given ample opportunity to evaporate before polymerization of the oil and the hardening of the gums take place. Several large japanning plants have equipment for "pre-heating" the material before subjecting it to the final baking. Steam coils operated at temperatures ranging from 250 to 300 deg. F. are employed for this purpose. In spite of the theoretical advantages and those shown by tests, it is very doubtful whether the preheating principle is of any practical advantage. If preheating is not used, the temperature

gradient will be substantially a straight line, increasing rapidly to a maximum at the entering end of the oven, in the case of a continuous equipment, and continuing at the maximum temperature throughout the baking period. It is obvious that uniformity of temperature throughout the oven is of the utmost importance. Lack of uniformity is very likely to result in hard, brittle, overbaked portions, or gummy and soft spots, which will collect dirt and dust as well as show excessive scratching.

It is desirable that the air supplied to japanning ovens should be controlled in some positive manner, as natural ventilation should not be relied upon. It has been the experience of those plants relying upon natural ventilation to maintain the air circulation that extremely variable results are secured. In these cases the ovens require constant supervision and the rate of production must be decreased to compensate for weather changes. The air used for circulation within the japanning oven must be relatively free from dust and as dry as possible. In some plants the precaution of washing the incoming air has been taken, but this does not seem to be necessary under ordinary operating conditions.

To secure a high grade finish it is customary to apply at least one primer or "rubber" coat, followed by from three to four finish coats. The primer coat is usually somewhat thicker than the others and carries most of the pigment. The treatment, application and baking of the three coats are substantially the same, as regards both time and temperature. The primer coat usually gives a dull or rough finish without hardness or brilliancy; the latter characteristics are supplied by the finish coats.

Japanning Plant Equipment

The japanning oven is one of the most important parts of the plant equipment, since on the proper operation of this apparatus depend the uniformity and quality of the output. While there are many conflicting requirements incidental to the succesful operation of japanning ovens, a few of the fundamental considerations are safety, reliability, controllability, economy, production and cleanliness.

Two fundamentally different mechanical arrangements are employed in the construction of japanning ovens, although both types consist merely of a large box, usually of metal, surrounded by from 3 to 6 in. of heat insulation. In the case of the earlier or batch type of oven, the material to be japanned is placed in the oven, the doors are closed and the temperature is raised to the desired point. The heating is continued for the necessary length of time, and usually some means of ventilation is employed. The batch type of oven when properly operated, will produce excellent results and is particularly adapted to small plants. The fuel economy in the case of the batch type of oven is usually much lower than in the case of the continuous oven, and the labor charges are much higher

The continuous japanning oven differs from the batch type only in that it is a long heat-insulated box, usually open at both ends, and equipped with conveying means for continuously carrying the material to be treated through the oven. Continuous ovens are constructed in many varying designs.

The question of ventilation for japanning ovens has already been discussed and it is merely necessary to give some typical figures illustrative of present practice. An oven adapted to the japanning of light automobile bodies, with an hourly production of about 12 bodies, will require an air circulation approximately equal to 1200 cu. ft. of fresh air per min. There are at present a large number of japanning ovens employing natural ventilation to cause the necessary air change. In my opinion this is unfortunate, since the operator cannot control the rate of circulation or the nature of the incoming air.

A second type of japanning oven represents present practice in the treatment of automobile fenders and similar light parts. It will be noted in this case that the entire process of dipping, dripping, baking, etc., is carried out automatically, and that manual labor is required only in placing the pieces to be treated on the conveyor, inspecting them and removing them when completed. There are two typical methods of reducing the leakage of hot air from the oven and the consequent entrance of cold air. Both methods depend upon the lower specific gravity of warm air causing it to rise. In the one case the oven is located on the roof, while the material to be japanned enters at one of the lower floors, passing up an incline before it reaches the hottest portion of the oven.

Heating Methods

There are at least three different means of supplying heat to japanning ovens. The oldest and least satisfactory arrangement consists in having a number of gas burners placed beneath the floor level of the oven and arranged so that the gaseous products of combustion will pass upward and impart a portion of their heat to the materials to be japanned. The objections are the temperatures are not subject to accurate control, the temperature of the ovens is not uniform throughout, the dangers of fire from an open flame are excessive and the products of combustion passing through the oven frequently contain traces of soot and always large amounts of water vapor. As a result of these conditions the quality of the work produced by an oven of this type is not as satisfactory as that of later types, and with the present price of gas the operating costs are high.

The electrically-heated oven has been widely introduced and is in successful use at a large number of plants. Electric heat allows simple and accurate control, permits a relatively uniform temperature throughout the oven and is free from the objections of soot and water vapor inherent in the gas-fired oven. The most serious objection to the electrically-heated oven is the extremely high cost of this form of heat. A consideration of the fact that even large power users cannot as a rule secure a lower rate for japanning equipment than from 1 to 1½ cents per kw.hr. will make evident the very high costs involved. For example, one large automobile builder producing approximately 1,000 cars per day, has a power bill for the japanning ovens alone of about $1,500 per day. For purposes of comparison, it may be stated that the same service secured from japanning ovens heated by the combustion of fuel oil would cost not over $400 per day, giving a yearly saving of over $300,000. It should be noted that while the electrically-heated oven can be most easily controlled and is normally very reliable, yet in this case the manufacturer is dependent upon power service. In case of any interruption of the central station service his ovens are closed, thus stopping all production and possibly causing a material loss of product.

The third and more modern system of applying heat to japanning ovens consists of the socalled air heated type, in which the ventilating air and radiant heating means are both maintained at the desired temperature by the combustion of oil or gas in a small separate oven composed of refractory materials that serves as a fire-box or combustion chamber in which the fuel is burned. Mounted above this are a series of air heaters which are divided into three groups. The first and smallest group is employed to supply preheated air for the combustion of the fuel in the heating oven. The second and largest group is used to heat a volume of circulating air which passes through flues arranged longitudinally along the sides of the oven and out, returning through a blower to the heaters. This volume of air serves to transfer the heat which is produced at high temperatures in the combustion oven, to the material to be japanned, where the temperatures are relatively much lower.

It will be noted that this latter air heated type of japanning oven permits of securing all of the advantages of the other types with the additional advantages of economy, reliability and controllability. It will be apparent that by the use of large radiating flues which cover substantially the entire sidewalls of the oven, and are maintained at temperatures about 200 deg. higher than that of the oven, a large amount of radiant heat is applied to the material to be japanned. On the other hand, the preheating of the circulating air insures that a large amount of warm entering air will be at all times passing through all portions of the oven, thus eliminating the "cold pockets" which are a troublesome feature of the electrically-heated oven. This forced circulation of warm gases also prevents the accumulation of the relatively heavy volatile products formed in the drying of the japan. The fact that the pressure within the japanning oven by this system is somewhat greater than the external atmospheric pressure, although only a small fraction of an ounce, overcomes the difficulty which is sometimes acute in the electrically-heated oven resulting from the flowing in of cold air in the horizontal type of oven, owing to the draft induced by the exit of the circulating air.

On the present basis of fuel oil, at approximately 4 cents per gal., it has been found that an oil consumption of not over 50 gal. per hr. will entirely supply heat to a continuous body japanning oven 140 ft. long and having an hourly output of at least 12 automobile bodies. This results in an actual fuel saving equal to nearly two-thirds of the cost. In the case of the air-heated oven described above it will be noted that none of the products of combustion enter the oven, and therefore the difficulties inherent in the earlier types of gas-heated ovens are avoided. Obviously no soot or water vapor is carried into the oven from the heating chamber.

Temperature Control and Mechanical Construction

To produce work of a high quality continuously the absolute control of the temperature throughout the japanning oven is essential. From the foregoing discussion on the properties and characteristics of japan, it will be evident that if the time in which the bodies are submitted to the baking temperature is kept constant, the temperature also must be maintained constant or the japan will be either under-dried or over-baked. Commercial practice has finally reduced successful temperature control to the basis of a pyrometer operated either by a thermocouple or a valuable resistance. In either case the change in an electric current caused by the change in the oven temperature operates a meter which is connected to a relay. The relay is used to close a power circuit controlling an electrically-operated switch, in the case of an electrically-heated oven, or an electrically-operated oil-and-air valve, in the case of the air-heated oven. The quickness of response to slight temperature variations is substantially the same in both cases.

In the case of an oven 75 to 150 ft. long, it is usually good practice to divide the temperature control of the oven into two or more sections, each of which may be controlled individually. It is not uncommon in the case of an oven 135 ft. long to place four thermocouples in the roof along the center line of the oven at approximately equal intervals. In this case the four sections of the oven would be controlled individually and automatically. It is also common practice to provide manual control in addition to the automatic control in order that the temperature of the oven as a whole can be varied when necessary. The necessity for such variation has resulted quite largely from the use of natural draft, and the consequent variation of oven performance with weather conditions. The necessity for such temperature variation is materially less in the case of those ovens in which the ventilating air is preheated and supplied under slight pressure, so that oven conditions and air circulation are independent of weather variations.

It has been previously pointed out that essentially the japanning oven consists of an insulated box provided with heating means and conveyor equipment. There are naturally many different mechanical constructions in use, many of which give satisfactory results. From the standpoint of heat insulation it is good practice to have the walls at least 4½ in. thick, and in case electric power is used for heating, a materially greater thickness is warranted because of the decided economy obtained in operation. It is desirable in designing the oven to have a minimum of exposed radiating surface per unit volume of useful oven space. When possible two or more ovens should be grouped together thus reducing radiating losses. In connection with the location of ovens, it may be pertinent to suggest that in many cases they can be placed on the roof, thus economizing floor space.

In constructing a japanning oven it is essential that the walls be air-tight in order that there may be no leakage of gases either into or out of the oven, other than as provided by the ventilating equipment. The oven structure should be as light as possible consistent with mechanical strength. Consideration must be given in the design to the fact that in a length of 100 to 150 ft. the total expansion resulting from a temperature change of about 400 deg. may be several inches. Particularly in case ventilating and heating flues are introduced and designed to operate at higher temperatures than the remainder of the oven, the factor of thermal expansion must be considered.

According to one authority, about 75 percent of the gasoline produced in the United States is obtained by direct distillation from the crude. About 10 percent comes from natural and casinghead gas, while only 15 percent is produced by cracking processes.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO.

Heptagon Building, 153 Waverly Place, New York City

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXIII August, 1921 No. 5

Some Further Methods of Lightening Motor Cars

ANNOUNCEMENTS of the newer models, as they are made from time to time, indicate that automobiles are being made with greater consideration for economy. By this reference is had to initial cost, as well as operating economy. The general price level is being reduced very slowly by the continuation of announcements of price reductions, the past month having seen about a dozen of these. The new models being announced appear to be more generally light fours than anything else, and an examination of these indicates a comparatvely small but powerful motor, a comparatively long wheelbase, and consequently, a good sized and comfortable body. As the smaller and lighter construction will make a car whose total weight is light, such a vehicle should be economical in every way.

To continue this trend will make for satisfaction for all concerned because such a car is a good manufacturing proposition, it will sell well, and this in turn will make for a large and stable production which will tend to keep price low or on a gradually lower level.

Considering this, the question arises in what way can cars be made still cheaper, that is what can be done to lower the manufacturing cost without interfering with performance.

American ingenuity will find a number of different answers to this, but as a suggestion, it is noted than an English publication suggests the elimination of the differential, at least on lighter and smaller cars. The point is made that the only real point in its favor is that it prevents the scraping of one tire in turning corners. Against this is urged that in principle it is wrong—it differentiates for resistance not distance as it should, consequently its uselessness on ice or in other slippery places, that it costs a considerable amount, and that it adds materially to the unsprung weight. The English writer referred to puts its cost in a well made car at the equivalent of $100, but it is not believed that an average in this country would be as much as half that.

Another good point made against it is that when climbing a hill with a rough surface, whenever one wheel bounces off the road surface, the differential transfers all the engine power to that useless wheel so that it spins at a tremendous rate, and loses power (which is fuel and oil) while in the air, also rubber when it comes down and contacts with the road surface again. The same situation exists on all rough roads, so that differential action can be charged with a large proportion of the fuel and oil used, rubber deterioration, also the carrying of excess power at all tires (so as to overcome, at least partly, this defect), and this in turn adds to the cost of fuel, lubricant and tires.

Similarly when braking the car, the differential prevents evenly distributed brake action, since it permits or more correctly forces, one brake to take hold quicker than the other. It is interesting to note that a number of racing cars have been built without differentials, here and abroad, and that these vehicles although working constantly around turns have shown a tendency to hold the road better, are better sprung, and to some extent ride better than those with the differential.

Considering all this, the question arises, is the alleged saving of tires directly attributable to the differential sufficient to warrant the retention of this device, and does its so-called advantages in use offset its disadvantages? A further interesting question in this connection would be, would the public now accustomed to have and to use a differential in all cars, stand for cars without it?

A Few More Price Reductions

AFTER the matter of price reductions for 1921 had apparently run their course, the middle of August saw several fairly large new cuts made, as well as announcements of 1922 models which carry lower prices. The cars concerned are well distributed, one in the $1,000-$1,500 class, one in the $1,500-$2,500 class, one in the $2,500-$3,500 class, and the other among the higher priced cars, while the 1922 announcements were in the $1 500-$2,500 class, and the other higher.

It remains to be seen what effect these will have, as all these concerns have been enjoying a fairly good business, so that it was not for the immediate moment that the cuts were made. It is possible these new moves may have been a wise attempt to stimulate the fall business, by preceding the general business recovery slightly and thus preparing the public mind for these particular products, and at the same time stimulating business in what is generally a dull or at least, a duller, season.

In the light of this latest development, it will be interesting to watch the other developments of the near future, in the way of additional announcements, new models, or other tendencies. In this connection, it is freely rumored that one of the best selling and best known of the medium priced cars, now above $3,500, is to cut off more than $1,000 as of Dec. 1, thus bringing this make back into its original price group. It will be interesting to see whether this rumor materializes or not.

Reducing Overhead Costs Instead of Wages

Sound and Very Effective Methods Employed by One Detroit Motor Car Manufacturer to Give Same Profits of Reduced Car Prices

THERE was a time last December when the automotive industry was at a very low ebb. Cancellations had wiped out the unfilled orders and shipments had eaten up the balance, while few if any, new orders came in from day to day. One large and widely known automobile company in Detroit picked out that time to cut the price of its car, but announced that it would not reduce wages until the cost of living came down and justified such action, says Don F. Kennedy, in Iron Age. This was a time when employment in Detroit, the center of the industry, was at a crisis. The city poor commission was swamped with demands for assistance which it could not fill. Clerks and stenographers from other city departments volunteered to work after hours to help the poor commission get caught up with the appeals of frantic fathers and mothers. All the chain grocery stores carried signs announcing that poor commission vouchers would be honored.

Factory after factory laid off men by the thousands. Some were running three days a week, some two days a week and many were closed tight, including some of the very largest.

At this time the writer interviewed the heads of representative manufacturing concerns to get their ideas toward labor in general, with particular reference to their intentions toward reducing wages. Some were more or less open in their remarks, some were afraid to talk on the subject, and a few refused to be interviewed.

This was six months ago, before the attitude of labor had had time to adjust itself to the thought of lower wages which it has since accepted—and quite gracefully, too, for the most part. All these employers had reductions in mind, but only a few felt themselves quite justified, or had the moral courage to say so. They were not sure that they were morally warranted in reducing wage rates; that their attitude would be in line with public opinion; that their workmen were ready to accept wage cuts without protest, although they realized that with the unemployment situation such as it was, they could put into effect any kind of a cut, and get plenty of men, no matter what the wage.

I said that all the employers had reductions in mind. There was one exception. His ideas were different. His plant was running three days a week Those readers who saw the article in question may recall that I quoted one man as saying that wages should not be reduced. and that his company for one would not reduce them until retail prices dropped sufficiently to warrant such a cut. His idea was that profits, overhead expense, manufacturing methods and material prices should be looked at closely, and reductions in expense made by cuts from these items rather than from the wages of the workmen.

Six months have elapsed and it should be interesting to find out how this theory has worked out in practice. I know that this attitude sounded more or less altruistic to me at the time. It was an admirable idea, but how practical? How would it work out in dollars and cents?

This company is one of the large automobile makers and a representative one. During the past winter it worked on an average of less than half time, which has about averaged up with the rest of the industry. It made a cut of more than $200 in the price of its car last fall. This represents more than the average automobile manufacturer's profit per car. The overhead expense of these enormous factories, filled as they are with expensive machinery, runs on day and night, whether the factory is running or closed. This company faced this situation; it was running less than half time, it had cut the price of its product as much or more than its normal profit. and it proposed to keep wages up to war-time standards.

How Has It Worked Out?

I called there again the other day and saw how it had worked out. I found that the first wage cut was being put into effect the day I called in the middle of May. It was almost six months from the time of the original interview. Comparison between the wages paid in that plant and those paid in other similar plants in the city showed that this company was paying higher rates than the average in every department. These figures are at the disposal of all members of the Employers' Association of that city.

Running less than half time and keeping up war-time wages, the company has actually made money every month! The seemingly altruistic general manager has actually put his plan into effect and made money while doing it.

"We are turning out a better car today," he said, "than we have ever turned out. Our standards of accuracy are higher. We, in common with all manufacturers, were inclined to let things slip a little during the great pressure that was brought to bear on the automotive industry during the past two years. We find, however, that everyone handling our cars is becoming more particular. The buyer now complains of little matters which formerly would have been overlooked. The dealer in the past would fix them up himself and say nothing. Now he complains to the distributor. The distributor collects all these instances together and brings them to the factory.

"Several months ago we brought to the factory in convention the service managers of our ten largest distributors, located in the principal cities all over the country. Together we went over the praiseworthy idea that a system or a report will make things go better.

"So he starts one, without the supervision of the executive who has a better outlook on the relation of that idea to the whole situation. Sometimes reports grow out of the necessities of the time. They continue long after their usefulness has ceased. Some are started in error; thy never had an adequate excuse for existence.

"Each individual has his own ideas. All want to improve on the work of their predecessors, which is quite

natural. It is the fault of the executives that so many systems are allowed to develop.

"And the cost of all these systems and reports may be just the differencec between profit and loss on the balance sheet. You start the memorandum system and it goes on indefinitely. A man writes a memorandum to a department with copies perhaps for several other departments. The memorandum gets attention, and the copies get attention, and they probably all get answered, which answers call for still further replies. These get interchanged, taking up the time of a lot of people, and the copies and answers clutter up the files so that you can't find what you do need. A virtual chain-letter system develops that keeps stenographers busy on unimportant work.

"There are not more than 100 memoranda in any one department in the course of a year that are useful three months after they are written."

"How did you happen to get started on this subject of eliminating reports," I asked him. "Where did you commence?"

"The first thing I did," he replied, "was to lay out on my desk all the reports that came into this office. They more than covered it. I analyzed them all to see how much of this information was actually necessary for the running of this business. I came to the conclusion that it could all be condensed in very much smaller space. Every report represents considerable time of various people in compiling it.

Started on His Assistant First

"My first job was to show my assistant that our system had run away from us so that our men were working for the benefit of the system, rather than using the system for the benefit of the balance sheet. He was the hardest man to convince. He finally saw things my way and together we went through this report business.

"We looked into our welfare department. Like everyone else who has had the subject of labor to contend with the last few years, we found that we had to take more interest in the problem. We developed a welfare department, and had been recently considering some additions to it.

"Looking into the various records and reports we had gradually developed, I came to the conclusion that we, as well as other employers, were acting as though the workman was a child to be held in our lap. We decided that we were interesting ourselves in a lot of things that were none of our business. What records are actually needed in hiring and firing? We came to the conclusion that our one original employment card has all the necessary information. This tells us when a man applies for work whether he has worked for us before; if so, when; how much he was making, and why he left.

"Several years ago we decided to manufacture some of our units that we had formerly purchased. I made an extensive trip around the country investigating systems developed by other manufacturers. I found one in an eastern shoe factory that had given desirable satisfaction and I decided that this or a modification of it was better adapted to the new work we were undertaking at our plant than any I had seen. I handed it over to our people to develop. They installed the system, and as is perfectly natural, 'improved' on it. The result was that we had to have a $5,000 man to run the system.

"Now I looked into the workings of our elaborate cost system. The first thing I found was that it didn't tell us our costs. None of these elaborate systems do. We made it both simpler and more accurate.

"Another system that had developed unnoticed to a point where it was costing us $12,500 a year was a cross ndex of the parts numbers of all the parts of each individual car. By means of it, knowing the number of the frame, the magneto and the clutch, we could tell the number of the car. You can see what a cumbersome thing this becomes when keeping track of cars by the 100,000.

"We have so simplified and condensed our records that our time study, stores and production systems are all under one head."

Many Inspectors Eliminated

"We went after our inspection system. The customary system is wrong end foremost. You pay a mechanic $1 an hour to produce accurate parts, and then pay a non-mechanic 50 cents an hour to watch the mechanic. The mechanic who knows an inspector will catch his errors won't try very hard to get the work right in the first place.

"We now hold the department foremen responsible for the work. The foreman of each operation is held responsible for his part of the work until it gets to the assembly line, where the first inspectors are stationed. We have almost entirely eliminated the use of inspectors on minor operations but use them to catch any work not up to standard at the various assembly points. In return for this responsibility we are paying most of our foremen a little more money than we did.

"We find that when the workmen know that it is up to them to turn the work out right with no inspector except their foremen to catch it if it isn't, they will do it properly in the first place. This change has given us better results at a lower cost.

"During the war times we hired a number of outside factories in which to make parts of our car. The cost of trucking materials to and from the branch factories and the main plant was a large item of the expense. This has been eliminated."

I asked him what they had done about contracts for raw materials, that is, about canceling them. "We have never tried to evade our obligations under a signed contract. I instructed our purchasing department to act under the theory that we made the contracts in good faith, and to act accordingly. We have made requests for reductions from most of our sources of supply with whom we had contracts, and have had very satisfactory co-operation from most of them.

Decided Stock Chasers are Unnecessary

"Another thing we have done is to eliminate all stock chasers. I came to the conclusion that we did not give our suppliers sufficient credit for being good business men, for wanting our business, and being just as anxious to ship their stuff to steady customers who always pay their bills on the 10th, as we were to get them. We have eliminated all of this expense."

"But what about your whole production line being held up for lack of some one part? Do you not consider a stock chaser needed for such emergencies?" I asked him.

(Continued on page 28)

National Wealth Promises Automotive Vehicle Market

By CHARLES A. DANA *

VERY sound is the future of automotive vehicle manufacturing in the opinion of one well-informed automotive executive, Charles A. Dana. He considers that with automobile (and truck) production ahead of the majority of other business lines, with our high standard of wages as compared to those of other countries, and with our continued increase in national wealth, the future of the motor industry is very sound and gives figures to prove his contention.

In this connection, the latest government figures (for 1919) show the value of the manufactured products of the country to be $62,588,000,000 and of farm products to be $24,961,000,000, or nearly five times the buying power of the year 1900.

The manufacturer estimates that the average replacement market for cars is 1,800,000, though in lean years the public may not buy as heavily with consequent larger markets in the years of plenty.

Dana also called for protection on agriculture, revision of taxes, and economy in government expenditure.

The letter says in part:

"Now, where are we in the automobile industry? It appears there are 9,200,000 registered passenger cars and trucks, which is approximately equal to the production of the last five years. Consequently we may assume that all other cars produced previously are scrapped. To maintain this number of cars on the road it is necessary to produce annually 1,800,000 cars, or 83 percent of the production of last year, and this figure does not take into consideration any new users of cars among those of our present 105,000,000 population, or for the steadily increasing population.

"Furthermore the motor vehicle as a producer of wealth is continually increasing the potential buying power of the country. The government figures for the last score of years, the period of the rise of the motor vehicle, show a vast increase in wealth as follows:

Value of Farm and Manufactured Products

Year	Farm	Increase	Manufactured Products	Increase
1880....	$2,200,000,000		$5,400,000,000	
1900....	4,700,000,000	114%	11,400,000,000	111%
1919....	24,961,000,000	431%	62,588,000,000	449%

Note—All figures from the U. S. bureau of the census, with the exception of 1919 farm products figure from U. S. bureau of crop estimates.

"Better transportation undoubtedly played a large part in this phenomenal increase in values.

Production at 87 percent

"An encouraging factor in the car and truck situation is that production is 87 percent of the same period last year. One large maker is 136 percent of the second quarter of 1920, whereas the bulk of the other companies are operating at 107 percent ahead of the first quarter 1921. or 57 percent of the second quarter 1920. Trucks are doing more than one-third better than they were the first of the year.

"Without reciting figures it is a well known fact that the wealth per capita is steadily increasing, and that the distribution is more widespread to a greater number of persons. Therefore, are we not well justified in feeling that the buying power per annum for automobiles is on an average at least 1,800,000 cars annually, and that the same will be increased by larger population and greater distribution of wealth?

Motor Trucks Essential for Short Hauls

"Can there be any debate as to the advisable use of trucks for short hauls? On an actual comparison of rates by trucks or railroad for a distance of 100 miles out of New York and Buffalo the truck appears to be the most economical, and without considering the additional advantage of service to the buyer by a prompt delivery and the reduction of inventory and working capital that is otherwise tied up in the longer time for transit.

Must Have Lean Years

"Such is the brilliant future we have to consider for our industry. One must remember, however, that ever since the Biblical Joseph's time there are years of famine as well as years of plenty and the wise Joseph is he who fills his granaries and reserves, or surplus account, with enough grain and money in the times of plenty to carry over the time of famine period. Such is the period we are passing through now, and the average of 1,800,000 cars per annum may not be maintained in 1921, but in 1922 or 1923 the deficiency is sure to be made up or you will have to contend that the automobile is losing in favor; and few will assume responsibility for such a statement.

"We can indeed look confidently to the future of this industry, when we realize that steel production is less than 20 years ago, copper mining is at a standstill, the market for raw cotton is glutted, sugar has dropped from 28 cents to 5¼ cents wholesale, and rubber has fallen from 54½ cents to 12 cents.

"While we with all others must share in this after-war and world-wide deflation both investor and manufacturer can most assuredly look forward to the continuation of our industry, that has together with the railroads and telephone been welded in our very social, economic and industrial life.

A recent ship from Amsterdam to Colombia brought two German hydroplanes for the use of the Colombo-Alemana Cia. de Transportes Aeros on the Magdalena river from Barranquilla to Girardot and Nieva.

A recent official census of motor car licenses in the Province of Santa Fe, Argentina, shows a great increase over previous estimates, especially in the country districts, and gives a total of 6,756 cars. An estimate for the entire Rosario district places the present number of cars at 15,000, of which probably 80 percent are American cars.

* President, Parish Mfg. Corp., Spicer Mfg. Corp., Sheldon Axle & Spring Co., and Salisbury Axle Co.

Red and White Oak Wood Distinguished by Pores

White oak wood has smaller pores in its summerwood than red oak, and this fact is now used by the Forest Products Laboratory, Madison, Wis., which is under the supervision of the forest service, United States department of agriculture, to separate the wood of the one group from that of the other.

Over 50 species of native oaks assume the proportions of trees and about 25 are used for lumber. After the oaks are cut into lumber there is no means known to the forest laboratory by which they can be identified as to exact species. By examination of the wood alone, however, it has been found easy to separate the oaks into two groups—white and red. For most purposes, fortunately, it is not necessary to classify them further.

A ready but not absolutely reliable means of distinguishing the white oak from the red oak is the color of the wood. Red oaks usually, but not always, have a distinguishing reddish tinge, especially near the knots. The wood of the white oaks generally is a grayish brown, but occasionally a reddish tinge is found in the lumber. For accurate identification it is necessary to examine the pores of the wood. These are found as tiny holes on a smoothly cut end surface. The largest pores are visible to the naked eye. The pores are not of uniform size throughout each growth ring, but are considerably larger in the wood formed in the spring, decreasing in size rather abruptly toward the summerwood.

To determine whether a piece of oak belongs to the white or the red oak group, the end of the piece is cut smoothly with a sharp knife across several growth rings of average width. With the aid of the hand lens the small pores in the dead summerwood are examined. If the pores in this part of the growth ring are plainly visible as minute, rounded openings, and are not so crowded but that they can readily be counted, the wood belongs to the red oak rgoup. If the pores in the summerwood are very small, somewhat angular, and so numerous that it would be exceedingly difficult to count them, the wood belongs to the white oak group.

The white oak group includes true white oak, swamp, bur, cow, post, overcup, and chestnut oak. The red oak group includes true red oak, yellow or black, scarlet, spanish, Texan, black jack, water, willow, and laurel oak.

S. A. E. Meeting January 10-13

The Society of Automotive Engineers has announced that its annual meeting will be held in New York City January 10-13. This follows the established custom of holding the meeting during national automobile show week when interest in the industry centers in the eastern metropolis. The S. A. E. dinner, which has become established as one of the most representative assemblies of automotive men during the year, will be held Thursday, Jan. 12. The celebrated S. A. E. carnival is set for the night preceding the dinner, Jan. 11, and the meetings committee is busy arranging details for both of these events even at this early date.

The plans for the technical sessions are developing and indications point to the arrangement of a very comprehensive and educational program.

The meetings committee suggests that members desiring to present papers communicate with the society offices at 29 West 39th street, New York, without delay, since it is desirable that the acceptance of all manuscripts be decided by October 1st in order to provide sufficient time for preparation and circulation of the preprints.

Lexington's New N. Y. Show Room

The Lexington Motor Co. of New York, Inc., eastern distributors of the Lexington Minute Man Six, has closed a lease for a motor car show room at the southwest corner of Broadway and 57th street, New York, which will be used by the company for the display of its product. The rental figure is understood to be $50 000 annually. The building is irregular in shape, fronting 54 feet on Broadway, having a side exposure of 63 feet on 57th street, the back wall line being 80 feet in length.

Contracts have been let for the interior decorations, whih will follow the Italian renaissance. Immediately inside the main entrance will be a heroic bronze replica of a Minute Man statue, the emblem of the Lexington car.

This announcement comes closely on the heels of the recent purchase by this cocmpany of a commodious service station in Long Island City, at an expense of $250,000, and the opening of a branch in the Bronx at 149th street near Mott avenue.

Say Ford Makes $199 From Each Car

Attention drawn to Henry Ford's own statement of his manufacturing costs has induced financial circles to continue the process in their own way to the point of estimating his cost per car. As brought to light this speculation is generally taking the form of an estimate that materials entering into the manufacture of a flivver do not exceed $50. This, added to the $93 which Ford confesses is his labor and overhead cost, gives a total of $143.

Matching this against the current price of a Ford touring car, $415, and deducting 17½ percent from this price as agent's commission, the financial circles described arrive at the conclusion that each touring car nets the Ford Motor Co. $199. This is checked freely against another recent estimate of a man who has been close to Ford that the net profit on a vehicle was $189. And the checkers have gone on from this and figured it out that the actual bench cost of a Ford, material and labor, but excluding overhead, is about $100.

The second annual automobile show of the Hudson County Automobile Trade Association will be held in the Fourth Regiment armory, Jersey City, N. J., Nov. 14-19.

Recently several automobiles have been received at the customhouse at Barranquilla, Colombia, from Czechoslovakia. Also an agent for a two-cylinder, two-passenger automobile of English manufacture has been active in Barranquilla. This car is delivered at Puerto Colombia for £295. Although a few sales have been made it is not thought that such a car will find favor there on account of its comparatively high price, and the fact that it is more of a novelty than a car for practical use.

Instrument Board Atop Steering Wheel

An instrument board for installation on top of the steering wheel has been developed and is being manufactured. The speedometer, oil gage, ammeter, ignition and lamp switches and any other indicating mechanism normally used in car operation may be mounted upon it, leaving the space ordinarily used for the instrument board and its connections free for storage compartments for gauntlets, lamps bulbs, spark plugs, curtains or any of the numerous other things that motorists like to carry on the car in a handy place. The control board is flush with the steering wheel and all of the indicating devices are directly in the line of vision of the driver, which is certainly a convenience.

Gasoline in Smaller Demand

Price cuts failed to make any material difference in volume of gasoline consumption as the bureau of mines refinery statistics of February show that the daily average of gasoline production fell off by one million gallons but the stocks increased by 108,000,000 gallons. The lessened demand was also reflected in increase of 18,000,000 gallons of lubricating oils in reserve with a decreased production of 185,000 gallons. The figures show that there were 680,540,351 gallons on hand at the end of February. Exports amounted to 52,497,051 gallons; shipments to insular possessions, 4,536,619; and domestic consumption, 225,195,372 gallons. The daily average consumption was 10,079,609 gallons.

Drop-Forged Auto-Wheel

The latest addition to the large variety of automobile wheels is the drop-forged steel wheel which is said to have a number of advantages to warrant its use. At the present time, it is made chiefly as a replacement for several types of small, low-priced popular cars. As compared with wood wheels, the forged steel wheel has the advantage that it consists of only a single piece and therefore has no joint to come apart. Being made of wrought steel, it is practically unbreakable. Even the brake drum is made in one piece with the wheel and where it fits to the spokes the joints are nicely rounded so as to prevent the accumulation of mud and dust at these points. All trouble due to the shrinkage of wood is eliminated, and if the wheel is made true in the first place, it should remain true. The drop-forged steel wheel is easy to clean and should prove particularly popular in arid sections where wood wheels give trouble owing to shrinkage.

New Positive Drive Differential

A positive-drive differential of the sinusoidal type designed by A. T. Nogrady has been the subject of investigation by various concerns in the industry. The differential is fitted with the bevel pinion and side gears in the usual manner. However, the bevel gears are fitted with either helical splines or sinusoidal cams that engage with external and internal members, the latter a portion of a member fitted to, or integral with, the main axle shaft. When the traction in either of the rear wheels varies, a cam tends to thrust the differential bevel gear, or side gear against clutch faces on the housing, thereby setting up a frictional load which is transmitted to the cage as a torsional load, and thus to the main axle shafts driven by the side gears. When operating under ordinary conditions, the effect due to the cam is to thrust the side gears inward and away from the provision for positive driving friction, and since the clutching faces are brought to bear one against the other, the thrust is equaled between the inner and outer clutching faces.

C. B. N. A. Convention

The forty-ninth annual convention of the Carriage Builders' National Association will be held at the Hotel Gibson, Cincinnati, Ohio, September 21 to September 23, inclusive. The business meetings and the exhibition of vehicle parts and the annual banquet will all take place under the Gibson's roof.

The C. H. A. T. will entertain during convention week of the C. B. N. A. with a dance, on the evening of September 21st. The ballroom of the Hotel Gibson has been engaged. The dancers will be entertained with music, punch and a general good time is in store for all who are fortunate enough to attend this affair.

Improved Condition of Standard Parts Co.

What is mentioned as a sign of recovery for the automotive and allied industries was contained in the decision rendered by Federal Judge D. C. Westenhaver of the northern Ohio district court in Cleveland, Aug. 15, answering the petition of Frank A. Scott, receiver for the Standard Parts Co. The court granted permission for a payment of a 10 percent dividend to creditors and stated that he was satisfied the company was being operated by the receiver in a sound and economical manner. The petition set forth that the company held a cash balance in excess of $1,500,000. A consolidated balance sheet submitted with the petition, showed the condition of the Standard Parts Co. to be improved.

Grand Central Palace Again to House Auto Show

Grand Central Palace will again be the scene of the annual national automobile show in New York City, January 7-14, 1922.

Decision was made earlier in the year to exhibit at Madison Square Garden if the Palace could not be secured. It was believed that the exhibition hall which has housed the New York automobile shows in recent years would be converted into office suites; and an option was accordingly taken on the Garden with the understanding that the larger quarters of the Palace would be utilized if available.

The national automobile show at Chicago will be held in the Coliseum and the 1st Regiment armory, January 28th-February 4th, 1922. Both national shows are under the auspices of the National Automobile Chamber of Commerce.

The number of automobiles and trucks in use in the Prairie Province of Canada has increased during the year by 11,283. The total increase for the dominion is given as 70,043. The following figures show, for the years 1919 and 1920, the number of motor vehicles registered in the provinces named: Manitoba, 1919, 33896; 1920, 36,455; Saskatchewan, 1919, 54,754; 1920, 60,325; Alberta, 1919, 34,362; 1920, 37,515.

Design and Construction of Oil Tank Trucks

How the Tank Body Should be Proportioned, the Various Types and Sizes — N. A. C. C. Standards—Tank Capacities—Other Details

IT IS of more than passing importance that the motor tank truck be properly proportioned both to its chassis and to its load of oil and the work to be done, in fact to the prospective truck owner, the truck agent making the sale, and the truck manufacturer whose product is being sold, it is of major importance. It is important to the owner because an unsuitable body never will give satisfaction, and consequently, never will be profitable. To the agent and manufacturer the importance lies in fitting the truck to the oil man's business so as to give him satisfaction, and thus get repeat orders and additional orders from other oil men.

No phase of the oil man's rolling equipment in the past, has been as little understood, and has had as little attention as the tank, its cradles and other accessories, says the Wayne Oil Tank & Pump Co. This has led to an overload being carried by gasoline trucks in a great many cases. These cases are distributed throughout the entire country. An overload will nearly always mean a rapid depreciation (a shortened life for the truck) and a heavy maintenance charge during its actual life. One of the reasons is that both truck manufacturers and tank builders have not carefully enough considered the question of the pay load and body allowance in relation to the actual body in question on the particular chassis on which it is to be installed.

The weights of finished tanks usually overrun very materially the estimated weight and also the weight of the body allowance. The writer has known finished tanks on trucks of two ton capacity to overrun the estimated weight by 700 pounds. This was an actual overload of that amount or a seventeen and a half percent overload.

There are two other causes of overloading that are squarely up to the oil companies.

One is the practice of taking a tank off a chassis for which it may have been properly designed and placing it on another truck of the same carrying capacity but with a less body allowance, different frame dimensions and a different distribution of the load.

The second is the practice of buying a chassis and tank which has been designed to carry a capacity load in the tank and without any provisions for can racks on the sides, and after the tank has been in service, to themselves build on the can racks and carry eight to twelve ten-gallon milk cans filled with lubricating oil, thus overloading in some cases as much as twelve hundred pounds. The writer knows of one case of this kind where the truck broke down completely after 18 months of service, and the oil company tried to place the blame on the truck manufacturer.

Elliptical Oil Tank Body for National Refining Co., on Service Truck Chassis, an Example of a Well-Designed Tank-Truck Combination

In considering the capacity of tank to be used on any chassis the first question to be decided is whether the truck will be required to carry lubricating oils, kerosene, etc., in milk cans in addition to its regular load. If so, the amount and weight should be carefully calculated and the tank capacity figured accordingly.

The truly cylindrical type of truck tank is not being used as much at the present time as it was previously

on account of the wasted space on the bed of the truck and the raising of the center of gravity, although from its shape it is well suited to resist strains caused by wrenching on the chassis during regular service and from accidents. The two most popular as well as the most practical types of tanks for truck service are the oval or eliptical tank and the semi-rectangular, that is, a tank with a square bottom and sides and a slightly arched roof.

The semi-rectangular type of tank is very popular with a great many oil companies even though it requires more metal and consequently more weight for the same gallonage. This type allows of a slightly better distribution of the load and has no waste room on the chassis which when the oval tank is used must be covered over or floored to avoid splashing the tank with mud. It also lowers the center of gravity of the load but can not be quite as easily drained as the oval type.

When considered from every standpoint the oval or elliptical tank has slightly more points in its favor than the semi-rectangular tank.

One of the causes for overloading is the fault of everybody connected with the design and purchase of the completed truck. The oil companies do not completely equip their trucks at the outset and both they and the truck manufacturer fail to give to the tank designer the total weight of accessories to be used and which weight must of course be deducted from the combined weight allowable for body and load. The designer on the other hand fails to thoroughly investigate the various weights to be added with the result that a very undesirable overload occurs.

The National Automobile Chamber of Commerce has adopted the following definition for a standard chassis for gasoline commercial vehicles.

"A standard chassis of a commercial vehicle to be propelled by an internal combustion engine shall consist of an assembly of all essential parts of a truck chassis with protective housings, ready for operation on the road; including a minimum equipment consisting of a set of tires attached to the wheels; a driver's seat with padding or cushion on all chasses rated at one ton capacity or more; front wheel fenders; running board or mounting step; tool compartment; priming coat of lead on all parts to be painted; pair of front lights and one tail lamp; license brackets; warning signal; jack and a set of tools commonly used for making adjustments and minor repairs on the road."

The manufacturer usually gives the weight of his chassis based on this definition. They also have a certain body allowance in addition to the live load which is applied to trucks of the various capacities.

The body allowance as used by some of the principal manufacturers of trucks are shown below. These figures pretty generally cover the range of maximum weights now in use. Those shown in bold face type are those in most general use.

Truck capacity	Body allowance in lbs.	Truck capacity	Body allowance in lbs.
¾ ton	600	1½ ton	**1,050**
¾ ton	**750**	1½ ton	1,100
¾ ton	850	2 ton	1,000
¾ ton	900	2 ton	**1,200**
1 ton	720	2½ ton	1,200
1 ton	950	2 ton	1,500
1 ton	**900**	2 ton	1,300
1 ton	750	2 ton	1,250
2½ ton	**1,350**	5 ton	1,500
3 ton	**1,500**	5 ton	**1,800**
3 ton	2,000	5 ton	2,500
3½ ton	1,400	5½ ton	**1,850**
3½ ton	1,500	5½ ton	2,000
3½ ton	**1,600**	6 ton	**1,900**
3½ ton	2,000	7 ton	**2,000**
4 ton	**1,700**	7½ ton	2,000
4 ton	2,300	7½ ton	**2,100**

It is quite evident from the definition given by the National Automobile Chamber of Commerce that the following equipment or accessories must be carefully weighed and considered as an excess body load and subtracted from the live load. In other words the weight of the skid chains and fastenings, difference in weight of wheels and tires usually furnished and those recommended in these specifications, hubodometer, governor, bumper and radiator guard, towing eyes, cab curtains, windshield, battery and battery box, generator, truck tank, cradles and sills, can box, buckets and funnels, piping, faucets, rear bumper, unloading hose, side can racks, gasoline and lubricating oil to be delivered and cans should be equal to but not exceed the body allowance plus the live load, both as specified by the manufacturer.

It is hoped that truck manufacturers will more nearly standardize in all matters of this character in the near future, as it will in turn very materially assist the oil companies and tank builders in a standardization of their equipment.

A rough check may be obtained for preliminary weights as follows: The weight of the tank together with its cradle, heavy piping, faucets, bucket box, bumper and side can rails is approximately for tanks of 400 gallons or less, 3.25 pounds per gallon of capacity; for tanks from 400 to 800 gallons, 2.75 pounds per gallon of capacity, and for tanks greater than 800 gallons, 2.50 pounds per gallon of capacity.

Figuring very roughly, eleven gallons added to the capacity of a tank of No. 10 gage metal will add approximately 100 pounds to the body and live load.

When buying the entire proposition should be carefully calculated as outlined herein. The trouble has been in the past that it has been largely a guesswork proposition by practically everybody concerned.

It can be readily seen that it is not practicable to attempt to put in tabulated form the various sizes of tanks best suited to any capacity truck inasmuch as the total capacity is controlled by the body allowance and accessories included in the factory weight of the particular chassis to be used and by the number of compartments, size of can box and type and capacity of can rails.

For example, the careful calculation of the capacity for oval tanks on two 2½-ton chassis of different makes, developed the following figures:

Truck No. 1

Truck not equipped with can rails for lubricating oils:

Compartment				Gallons
1.....	with	bucket	box.....	680
1.....	without	"	"	690
2.....	with	"	"	665
2.....	without	"	"	675
3.....	with	"	"	650
3.....	without	"	"	660

Trucks of ¾-ton capacity, one compartment tanks only.

Trucks of 1-ton or over capacity, one or two compartments.

Trucks of 2-ton or over capacity, one, two or three compartments.

Trucks of 4-ton or over capacity, one, two, three or four compartments.

In order to secure additional gallonage on a truck the mistake is sometimes made of building the tank of too light a material. The gages specified in the table are as light as should be used and at the same time are heavy enough to give rigidity and strength.

Occasionally leaks will develop in the bulk heads of compartment tanks. This becomes a very serious matter when different compartments are used for different commodities. Serious accidents are likely to be caused and to be followed by costly damage suits by kerosene being contaminated with gasoline. Heavy loss is also likely to occur through the contamination of lubricating oil by either gasoline or kerosene. The best method to determine in just which bulk head such a leak is located is to have a drain cock in the space between the bulkheads.

To facilitate accurate accounting, checking of stock and employees and also assist the tank loaders, a permanent gage mark should be made in each compartment.

Manholes are almost indispensable especially in compartment tanks when a leak develops in the bulkheads. The criticism has been in the past that they were designed so as to incorporate too much weight and in many instances they were of such small diameters that they would not permit even a small man to enter the tank. Another item for criticism in the past has been the design and size of the filter plug in the center of the manhole. They should be of such design as will allow them to be opened and closed by hand and at the same time not become loosened by vibration on the road. It is extremely poor practice to allow the use of a hammer. It not only soon ruins the thread but a spark is often made which may result in a bad fire. Plugs that are designed to be opened and closed with either a spanner or a socket wrench usually end by being ruined with a hammer because the wrench has become lost or mislaid. The use of a hammer has also been the cause of ruining a number of vents.

Any motor truck to work efficiently, that is, show an earning in the transportation of merchandise, must use a comparatively small percentage of its working hours in standing still in loading or unloading.

Less than three years ago some truck tanks were still being constructed with two inch filler plugs. Today a four inch and usually a six inch filler plug is in almost universal use while one company is experimenting with an eight inch plug on some of its larger units.

The area of a two inch plug is 3.14 square inches while the area of a four inch plug is 12.56 square inches, or nearly four times as large, and a six inch plug has an area of 28.27 square inches or nine times that of a two inch plug.

It is therefore readily understood that if the truck filling rack is properly designed and is equipped with a large pipe and quick-acting valves, a truck receiving its load through a four or six inch opening will be loaded and ready to start on its route in less than a third of the time required for the truck equipped with a two inch opening from the same head or pressure and small piping.

This may seem like a small item but at distributing plants where a fleet of trucks from ten to twenty in number fill every morning or at other times in the day it may mean from one to two hours or possibly a full load delivery for the last trucks coming to the filling rack.

Every tank regardless of its size should be equipped with surge plates. This will tend in a measure to stop the violent shifting of the liquid when the tank is only partially loaded. Care should be used to see that they are so designed and placed in the tank that a man can enter for the purpose of making repairs, etc.

The piping of the tank is one of the most vital questions we have to consider in connection with the design of this class of equipment and plays an extremely important part in the earning power of the truck. The principles involved are generally the same as those governing the size of filler plugs.

The old time horse-drawn tank wagons were piped with ¾-inch and later with one-inch pipe. When the motor truck first entered the field of gasoline distribution they were equipped with one or one and a half inch pipe. The one and a half inch is being used by the majority of tank builders and oil companies today.

In the summer of 1918 experiments with two, three and four inch piping were conducted by one of the oil companies for dump load business. A one and a half inch pipe has a discharge area of approximately 1.77 square inches while a three inch pipe has a discharge area of 1.07 square inches or about four times as great although the diameter has only been doubled. It does not follow that the actual discharge in gallons per minute from a tank truck is going to be in the same proportion as the rate of discharge is governed by the head or depth of the liquid which is constantly diminished as the discharging process proceeds. It will however greatly decrease the actual time spent in unloading. Larger pipe also reduces friction which in turn reduces unloading time.

A truck carrying a 1,500-gallon tank of three compartments with one and a half inch pipe required one hour and twenty-six minutes to unload and when equipped with three inch piping required only twenty-eight minutes, or a saving of 66⅔ percent in the actual unloading time.

It was found that trucks with the larger piping were able as a general thing to deliver one extra load a day and in one case a fleet of twenty-two trucks was reduced to sixteen and at the same time actually delivered a greater gallonage. The net result was that the cost of delivery per gallon was reduced from one and a half cents to six-tenths of a cent. It must be remembered that this is an actual added profit of nine-tenths of a cent per gallon.

Experiments are now being conducted with still larger capacity trucks equipped with four inch piping and it is believed that they will reduce the cost of delivery per gallon another quarter of a cent.

It is of course understood that in order to carry out the above piping scheme and reduce the unloading time that it is necessary to use larger fill pipes on the underground storage tanks and in a number of cases it will also be necessary to substitute larger storage for those now in use at filling stations and other bulk customers. It is very seldom economy to leave the distributing plant with less than capacity loads.

One oil company has in the past two years replaced an extremely large number of tanks varying in size from 500 gallons to 2,000 gallons, and have always doubled and sometimes trebled the capacity. These tanks were not only at their own filling stations but also at garages and other customers whom they were serving.

The size of the fill pipe should be of enough larger diameter than the piping on the truck to allow an easy entrance of the hose and also for additional venting.

The sizes shown in the following table will meet all requirements in this respect:

Size of truck piping	Size of fill pipe
1½"	2"
2"	3"
3"	4"
4"	6"

On single compartment tanks of 600 gallons or more capacity it is well to use a flange of greater diameter than the piping so that the piping may be further enlarged at any time in the future without the expense and loss of time in putting on new flanges.

Some tank builders will protest the practice of large piping because of the additional weight and extra cost of the piping. If the entire design is properly worked out, this additional weight will not affect the gallonage which can be carried and the added cost becomes almost a negative quantity when compared with the reduction in the cost of delivery.

Large piping will be of vital necessity should an auxiliary truck transport system be organized to work economically for the purpose of delivering large quantities between centers of population at such times as rail systems or any part of them might become paralyzed from any cause which would prevent the normal use of the tank cars.

When trucks are to be used in a bucket delivery service, the piping should be reduced to two inches by the use of a swedge nipple and a two inch tank wagon faucet used. This is the largest faucet which can be used for filling a five gallon tank wagon bucket without spillage. This method will permit of the truck being changed from a bucket service to a dump load with hose service or vice versa in a very few minutes.

The larger piping on account of the additional weight through the vibration caused by poor roads is slightly more apt to develop leaks. To properly provide against such an accident with its resulting loss of stock and the probability of fire, and to insure accurate loading and gaging of tanks and to make possible the rapid and safe putting on and removal of faucets and to prevent the loss of stock through faucets becoming opened by road vibration, each compartment should have accurately fitted into the inlet side of the discharge flange, a quick-acting emergency valve, and should be operated by a lever at the top of the tank. These valves should always be kept closed except when a compartment is actually discharging.

The absence of emergency valves on a tank truck of gasoline was recently the cause of a fire resulting in over $50,000 of damages which were finally paid for by the oil company.

Another thing that should be carefully watched is the arrangement of the piping and see that all unnecessary bends and angles are elimina'ed. An unnecessary bend causes friction and results in a slower discharge. It is never necessary to use more than one 90 degree and one 45 degree elbows in a line and yet the writer has seen any number of trucks with three 90 degree elbows in the line.

Tanks have been built with a one and a half inch flange, a short one and a half inch nipple, a tee of the same size and two one and a half inch lines to the rear of the truck, each line containing a 90 degree ell, under the belief that the two lines could unload faster than one. As a matter of fact the two lines, on account of the unnecessary ells were actually slower than a single line of the same size and properly laid out would have been. The only way in which these two lines could be made to work faster would be to use a pump which would be the same as increasing the head. All pipes should be carried in hanger from the under side of the cradle as an additional preventative against leaks.

The trend on end of pipe where the faucet is to be attached, all threads on the faucet and the threads on the hose connections should be the same for all trucks in order that hose and faucets shall be readily interchangeable on all units.

The rear end of the piping and faucets should be protected by a substantial bumper. The absence of the bumper on a loaded tank truck has also been the cause of one or two disastrous fires.

Another item that is often overlooked is to see that the piping and faucets are so spaced and the bumper so designed that a tank wagon bucket can be hung on all faucets at the same time.

The tank cradle may be either wood or padded metal bolsters placed directly on the chassis frame or on wooden sills attached to the frame. A type of cradle is coming into use known as the "steel partition mounting" by some companies. It consists of steel bolsters resting directly on the frame. The cradle is really formed by an extension of the compartment bulkheads. It is claimed that this type of construction gives a considerable reduction of weight without any loss of strength or rigidity.

Regardless of the type of cradle used the frame of the chassis should never be weakened by drilling it in order to secure a fastening. "U" bolts or similar fastenings should be employed.

The fastening of the tank to the cradle of the former type is best accomplished by straps passing over the tank and into or through the bolsters and made adjustable by turnbuckles. On tanks of extreme length sway braces should also be used.

One oil company endeavored about four years ago to solve its transportation problems by designing a platform body with rollers in the bed and with platforms at the loading rack the same heights as the body of the truck and also fitted with rollers.

The sills and the cradle were designed so that the tanks could be moved between the chassis and the loading platform and be locked into position when on the chassis. For a fleet of ten chassis working out of one plant they employed fifteen tanks.

Empty tanks were run on to the truck loading platform and filled while the trucks were delivering. When a truck came in the empty tank was taken off and placed on the filling rack platform, and a loaded tank taken out immediately. In this way a chassis did not stand idle while

being filled and it was found that a truck actually delivered a third more gallonage. However the system was finally done away with as the maintenance on the chassis, tank and loading platform became excessive and a great deal of additional labor was required to move the bodies.

The bucket box should be of such size as will accommodate all of the buckets, funnels, etc. The practice of carrying them on hooks or hanging on the faucets or on top of the bucket box is a poor one, and for this reason the round top type is specified. Experience has shown that the bucket box will give better service if welded to the rear of the tank than when fastened to the sills only. A metal box is far better than a wooden one while a metal box with a wood lining is believed to be the best. Two types of doors are in general use. The double swing door with side hinges is the type in most general use although the writer prefers the single door hinged at the top.

The side can racks may be any one of a number of types now on the market. It is largely a matter of personal choice. The floor is usually of wood with rails of open pipe work or of pipe with sign panels of wood. The opening or gate for getting the cans in and out may be of chain or telescope pipe. These guard rails are also constructed of wood with sign panels and may be hinged at the bottom to drop down or may be of the stake and socket type.

The question of drawings is as important in this case as in the chassis, therefore, the tank manufacturer should be required to submit detailed drawings showing all dimension, methods of construction, all weights should also be accurately given. Everything should be carefully checked by both the oil company and the chassis manufacturer.

Reducing Overhead Instead of Wages

(Continued from page 20)

"Why chase one temporary item?" he replied. "As soon as that is found some other item is missing, and so on. No, we have stopped them all. We have also eliminated this local stock chasing around town which is peculiar to Detroit. In other cities, supply dealers deliver their material. Here in Detroit we send out pick-up cars and collect our various purchases here and there. We have stopped them all, and their salaries and traveling expenses.

"We have consolidated departments. The simplification of our system has rendered unnecessary certain high-salaried department heads. It has cut out useless effort on the part of a lot of clerks stenographers and department heads. We combined the functions of several departments under one head, instead of three or four. We have cut out straw bosses and inspectors. Our workmen are contented. They are producing more per man. They have a most kindly feeling toward our company which I know will last for a long time, and we have the satisfaction of knowing that we followed a policy we felt to be right, and made money for our stockholders while doing it."

I admit that this is a feat, one worthy of study and thought. This man's experience goes a long way toward answering the question so often asked when such questions as upholding wages arise: "We know it sounds ideal, but is it practical?"

S. A. E. Will Standardize Body Names

The Society of Automotive Engineers (passenger body division) has set to work on the problem of bringing order out of a chaos of body nomenclature, that has grown up with the business. They propose to standardize passenger car body names so that when a certain name is mentioned or seen in print we will not have to guess whether the thing is a bird or a beast, a microbe or a new kind of breakfast food.

George J. Mercer, expert body designer and a member of the S. A. E., was appointed to draft a tentative report with recommendations for a more stable and scientific nomenclature than that hitherto prevalent. Mr. Mercer has submitted his report, which is an excellent foundation upon which to erect a sensible system of motor body naming. The report is yet to be acted upon by the passenger car body division, the standards committee and the society. The whole report is still open for comment, favorable or adverse, and the S. A. E. invites such comment from all men who feel qualified to advance opinions or suggestions. All such criticisms will be referred to the members of the passenger car body division at the time the report is acted upon.

After reading and studying Mr. Mercer's suggestions, if you have opinions that in your judgment will aid the S. A. E. in formulating standards of body nomenclature, kindly communicate them to Charles E. Haywood, standards dept., Society of Automotive Engineers, 29 West 39th street, New York City.

Mr. Mercer's Report on Body Names

"A word of explanation is, I believe, necessary to explain the method used in deciding upon the body names recommended. All body types are undergoing changes. Sometimes the change is practically permanent, others last for only a season or two. Therefore the broadest fundamental definitions of the various models have been given and variations that have existed for some time as distinct models are listed separately.

"It is intended that by the time the names have been revised and accepted by the passenger car body division, drawings will be ready to accompany each model described.

"The term phaeton was adopted with misgivings, but on investigation it was found that a number of prominent passenger-car manufacturers have adopted the name. It may seem strange that one manufacturer calls a small touring body a phaeton and another manufacturer calls a similar body a touring body, yet custom has established this precedent and it is the writer's intention to give due regard to custom.

"(1) Roadster—A small, open-type body, with one fixed cross seat for two passengers and a space or compartment at the rear for carrying luggage. Emergency seats are sometimes made to fold into the luggage compartment or are located on the running-boards. Usually this body has two doors. The conventional type has a folding roadster top with emergency side curtains that are removable.

"Sometimes the roadster is made with a seating capacity for three or four on two fixed cross seats and is known as a four-passenger runabout. In this type the doors open direct to the front seats and access to the

rear cross seat is obtained by an aisle that divides the front seats.

"(2) Touring—An open-type body with two fixed cross seats for four or five passengers. It may have folding emergency seats in the tonneau for two additional passengers. The body has four doors and a folding touring top with emergency side curtains that are removable.

"(3) Touring-Phaeton—When a passenger-car manufacturer markets two sizes of touring car bodies on the same size of chassis, the smaller model is sometimes called a phaeton. Generally one is called a seven-passenger body and the other a five-passenger body.

"Sometimes the touring model is made with the front seats separated by an aisle of sufficient width to permit a person to pass between them. This type is sometimes called the salon-touring body.

"(4) Sedan—An enclosed single-compartment body with two fixed cross seats for four or five passengers. Sometimes the front seats are divided by an aisle and the body has folding emergency seats for two additional passengers. This type of body may have two, three or four doors. There are three movable glass windows on each side and the roof is fixed.

"(5) Berline—A body of the same description as the sedan, except that there is a partition at the rear of the driving seat that makes it an enclosed two-compartment body. One window glass in the partition is made to move vertically or horizontally

"(6) Coupe—An enclosed single-compartment body with one fixed cross seat. This seat may be straight and seat two or staggered and seat three. With the latter arrangement a collapsible seat may be placed by the side of the driving seat, thus making it a four-passenger body. There are two doors, two movable glass windows on each side and the roof is fixed.

Sometimes the seating plan is to have the two-passenger portion of the cross seat set back so that the passengers sit back of the driver's seat. The fourth seat is then usually a collapsible seat, but set back further.

"(7) Coupelet—A body of the same description as the coupe, except that the top is collapsible. There is only one movable glass window on each side. The rear quarters and back above the belt and the roof are covered with leather or imitation leather. The front pillars or windshield standards are fixed. The doors are of the landau type with flappers or folding upper frames, and the top back of the front pillars is entirely collapsible.

"(8) Limousine—A partially enclosed body with a fixed roof that extends the full length of the body and is attached at the front to the windshield standards. Only the rear section of the body forward to the partition at the rear of the driving seat is fully enclosed; forward of this point the sides are enclosed only from approximately the belt downward. There are two low doors and one fixed cross seat for two in the forward section. In the rear section there is one fixed cross seat for two or three and sometimes two emergency collapsible seats. There are two doors in the rear section and two movable glass windows on each side.

"(9) Brougham—A body of the same general description as the limousine, except that the fixed roof extends over only that section of the body that is entirely enclosed.

"The brougham as originally used on carriages had only one movable glass window on each side. Occasionally, it is made this way for passenger cars.

"Landau and landaulet bodies have been superseded or used in combination with other types, because the true landau does not have a sufficient body length for passenger-car use. The coupelet is a landaulet with the exception that the manner of folding the portion of the roof rail over the door is made with a different hinging arrangement and the front pillars are fixed. The cabriolet has superseded the landau, but it is different in that the falling-pillar hinge has a large swinging radius and therefore permits the rear section to be large enough for present uses. Both the coupelet and the cabriolet make use of the landau type of door, whereas the combinations, limousine-landaulet and brougham-landaulet, make use of the landau falling-pillar hinge, but do not use the landau type of door.

"(10) Limousine-Landaulet—A body of the same general description as the limousine, except that the top back of the rear doors is collapsible. Forward of these doors the roof is fixed and the windows are the same in number as for the limousine. The rear quarters and back above the belt and the roof are covered with leather or imitation leather.

"(11) Brougham-Landaulet—This type of body has the same relation to the brougham that the limousine-landaulet has to the limousine.

"(12) Cabriolet—A partially enclosed body, the two sections being the same as with the brougham. The roof and the pillars forming the partition are fully collapsible. The rear doors are of the landau type with either flappers or folding upper sections. There is one movable glass window on each side. The rear falling-pillar hinge has its center located far enough back from the face of the pillar to throw the top when falling back of the rear bar and the parting-line from the pillar face to the hinge center is generally a segment of an oval and shows plainly. The rear quarters and back above the belt-line and the roof are covered with leather or imitation leather and the back and side roof corners in the conventional design have a larger radius than in other types of closed bodies. The interior seating arrangements are for two or three passengers on one fixed cross seat and small folding seats facing back for two on the partition.

"(13) Town-Car—This term is used for body types that are designed particularly for local use, such as for shopping in cities and applies to chauffeur-driven cars only."

The Czecho-Slovak Automobile Club (Ceskoslovensky Klub automobilistu) will hold its thirteenth International Automobile Exhibition during the week commencing May 28, 1921, in the Industrial Palace and other buildings at the exposition grounds. The exhibits are to include passenger automobiles, trucks, motor plows, tractors, motorcycles, as well as various implements and apparatus used in the production and the propulsion of vehicles of this class. Seventy-four automobile firms were represented at last year's exhibition, which drew a large number of visitors. The executive committee is particularly anxious to see as many American firms represented as possible. Application blanks and other information can be obtained directly from the club or from the Czecho-Slovak Legation at Washington, D. C.

Further Lamp Standardization by S. A. E.

The standardization of tail-lamp over-all dimensions and mounting screws has been undertaken by the S. A. E. standards committee. At the present time there are a great variety of mountings used which could easily be reduced to one standard design, acceptable to both the lamp and the automobile manufacturer.

Standardized tail-lamps can be mounted on either the right or left-hand side of the license plate, thus eliminating the necessity of making right and left-hand lamps which is the practice at present. The tail-lamp dimensions recommended are in accordance with present practice.

It has been suggested that the present S. A. E. standard for lamp glasses, page D6 of the S. A. E. handbook, be extended to specify the dimension of the locking lugs of the head-lamp glass rim so as to prevent the glass turning in the lamp, which is a matter of importance in other than plain lamp glasses.

Census Figures on Carriage and Wagon Industry

A preliminary statement of the 1920 census of manufacturers with reference to the manufacture of carriages and wagons, and of bodies, spokes, wheels and other materials used in the production of the complete vehicles, has been prepared by the bureau of the census, department of commerce. It consists of a detailed statement of the kinds, quantities and values of the various products manufactured during the year 1919.

The number of establishments engaged in this industry is rapidly decreasing, returns being received from only 2,666 establishments in 1919, as compared with 5 286 in 1914. The number of vehicles manufactured in 1919 was 695,200, valued at $66,083,000, as compared with 1,177,400, valued at $72,284,000 in 1914. The total value of products for the industry was $129,602,000 in 1919, of which $63,519,000 represented products other than complete vehicles, such as bodies, spokes, wheels and other carriage and wagon materials, repair work, etc.

Information on Auto Market in Latin America

In view of the growing market for automobiles in Latin America, the information now available at the Bureau in the form of replies to questionnaires which were sent to certain government representatives in Latin American countries may be of interest to American firms. This information has to do with the general economic conditions prevailing, with special reference to the automobile industry. Reports have been received from the following countries: Argentina, Brazil, Chile, Cuba, Equador and Peru. Loan copies may be obtained from the Latin American Division of the Bureau of Foreign and Domestic Commerce or from the New York district office.

Considerable interest is being shown in tractors in Egypt. From recent experiments it is apparent that small tractors of low power will not meet the requirements of Egypt, due to the heavy soil, and further that it will probably be necessary to use disk plows. The trials under way are expected to settle this point.

Data on Dominion Motor Car Industry

All of Canada's automobile factories in 1919, 11 in number, were located in Ontario, although factories will soon be constructed in some of the other provinces. Alberta had two plants for the manufacture of automobile accessories, British Columbia 6, Manitoba 3, Ontario 26, Quebec 3, and Saskatchewan 2. Of automobile repair shops, 96 were located in Alberta, 78 in British Columbia, 81 in Manitoba, 34 in New Brunswick, 49 in Nova Scotia, 600 in Ontario, 2 in Prince Edward Island, 162 in Quebec and 134 in Saskatchewan.

The amount of money invested in the Dominion in land and buildings for the manufacture of automobiles, accessories and repairs was $11,282,406; machinery and tools, $9,953,619; material on hand and stock in process, etc., $20,064,682; cash, trading and operating accounts, $15,642,311; making a total investment in the industry of $56,943,018. In all the automobile, accessories and repair plants in the Dominion there were employed in 1919, 11,336 males and 803 females, who received wages amounting to $15,389,742 during the year.

Touring Cars Form Largest Class

The cost value of the materials delivered at the factory or works, including freight and duty for each section of the industry was:

The selling value at the factory or works of all products made during the year for each of the sections was: In automobile plants, $80,619,846; in automobile accessory plants, $8,571,890; in automobile repair plants, $12,004,970; a total of $101,196,706. Classification of cars, etc., manufactured by number and value, gives the following totals: Touring cars, 61,257, value $52,576,524; runabouts, 3,026, value $2,194,518; closed cars, 4,125, value $3,985,264; chasses, 11,528, value $5,053,862; delivery wagons, 372, value $270,254; trucks, 7,527, value $4,849,398; tractors, 2,094, value $726,576.

	Cost value at works
Automobiles	
Steel bars and tubing	$1,264,305
Malleable iron and steel castings	2,329,830
Lumber	3,207,308
Bodies	9,851,443
Parts and accessories	11,927,533
Tires	12,388,576
Motor truck parts	4,779,141
Trimmings	2,612,770
All other	3,329,809
Total	51,690,715
Automobile accessories	
Brass and copper tubes, rods and castings	405,549
Steel—bar, sheet and castings	806,632
Lumber	1,314,839
Malleable and gray iron castings	91,240
Bolts, nuts, rivets, tacks, etc	589,487
Top materials	1,319,872
Glass and celluloid	313,192
All other	1,380,628
Total	6,221,439
Automobile repairs	
Parts and accessories for repairs	4,368,810

Utilization of Oil From Rubber Seeds

There is every possibility of utilizing the large quantity of seed now being produced on rubber plantations in the Dutch East Indies, according to Holland's East India. In the early stages of the rubber industry in these islands the seeds were used mostly for raising plants in making new plantations, but as there are now more than 1,000,000 acres under rubber trees the quantity of seeds available is much in excess of the planting requirements. Investigations made many years ago by the Imperial Institute showed that the kernels of Para rubber seeds yield a large amount of oil similar in properties to linseed oil, and that this oil can be used for paint making and other purposes for which linseed oil is employed, while the cake which is left after the oil has been removed from the kernels is an excellent fodder for live stock. Until the last year or two the oil was only used on an experimental scale, but at least one oil mill is now established in Malaya for crushing rubber seeds and small commercial consignments of the oil have been sold in Europe at good prices.

Whether it will pay the planter to supply the seeds to an oil mill depends very largely upon the cost of collection, a point upon which experts differ. In view of the present necessity for the exercise of rigid economy on rubber estates and of the enormous demand for oils and feedstuffs, it is highly desirable that serious efforts be made to organize the collection of Para rubber seeds wherever it may prove profitable and so prevent waste of material which is undoubtedly of considerable value.

How to Paint Radiators

Car owners experienced a whole lot of trouble with the painting of radiators because the painter who did the work did not understand how to do it. The painter is inclined to forget that the air passages through the radiator are of extreme importance and must not be clogged up because they really form the breathing apparatus. Unless the paint applied to the radiator is applied in thin body, successive coatings will clog these air passages. It not infrequently happens that the painter is the object of much faultfinding on the part of the car owner from this very trouble, and it is sometimes the case that he has to clean this surplus paint off at no small expense. The radiator needs simply a very thin coat of some good wearing pigment.

For many of the dark colors such as black, dark blue, deep green, or maroon, liquid asphaltum, a product of bitumen, serves the purpose in good shape. Cut the asphaltum down to a rather thin consistency with pure turpentine and apply it in a temperature of from seventy to seventy-five degrees so that during application it may maintain the same thin body. For a pale yellow, buff, or light brown car, ordinary gold bronze will make a good material for this work. Mix the bronze in two-thirds coach Japan, or pale drying Japan, and one-third finishing varnish. If this bronze is suspected of being a little short of the best quality it had best be thinned out after mixing with the above ingredients with benzine or an eighty-eight degree gasoline. The veridgris contents of the mixture will come to the top, and with the evaporation of the benzine or gasoline, will remain there. In eight or ten hours this verdigris will be largely extracted. Upon removal the bronze may then be again mixed with a result that you will have an article far superior to the original mixture, both in brilliancy and in durability. The best results obtained with the use of bronze upon these parts are however secured by using the bronze in a dry form. Simply mix the Japan and finishing varnish in the proportions above stated and apply with a camel's hair brush. When this coat has dried down to the proper tack, which will be a tack just sufficient to catch and hold fast the dry powder, proceed to apply the dry bronze, using for this purpose a camel's hair brush which has not hitherto been used in any wet pigment. The bronze so applied will have a high, bright lustre, and if of good quality, will wear better than when applied as ordinary paint.

Aluminum bronze is largely used for radiators and in combination with any of the lighter colors it gives a good account of itself. Used upon a car painted black or deep green or dark blue, the aluminum presents a white appearance, and in fact upon superficial examination might be mistaken for white paint. When either of the bronzes are applied in paint form, the best thinner, all things considered, is what is commonly known as lacquer thinner or banana liquid.

Cracking of Paint and Varnish

No subject exceeds in importance this one. Paint and varnish fissures are surface disturbances against which the reputable painter is constantly waging a vigorous warfare. The natural destiny of varnish, and of the finish in general is to fissure and crack. It does this eventually by virtue of age, loss of vitality, action of the elements, and the reducing forces of service. There are many cases for this early perishing and breaking up of the finish, among which may be mentioned inferior material, a poor quality of varnish, mixing of two or more makes or grades of varnish, using one make of rubber varnish and over it another make of finishing varnish, also unseasoned wood, imperfectly dried coats of surfacer, paint or color, or colors containing a lack of or an excess of binding material.

Poland Now Has a Fiat Plant

Poland's first motor car factory has been opened at Warsaw with a capital of five million Polish marks under the official title of Spolka Akcyjna Samochodow Polski Fiat. The new enterprise, generally described as the Polish Fiat is an offshoot of the Italian Fiat Company of Turin, half of its capital having been subscribed by Polish financiers and the rest being of Italian origin. The Polish company is reported as having an up-to-date factory and modern garages at Warsaw with a branch at Lodz and representatives at Lublin, Posnan and Leopol. The works are now in full production under the technical direction of the Italian Fiat organization with business conditions described as being exceedingly promising.

A prominent American manufacturer who has been investigating the market for bolts and nuts in Norway states that almost complete control of the Norwegian market has been secured in recent weeks by German houses. It is stated that German firms are now quoting lower prices and filling orders in less time than Norwegian factories.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Ford Motor Co., Detroit, has construction under way on a new building at Northville to be equipped as a welding works, and used primarily in connection with the manufacture of valves and valve stems.

Phillips Steam Car Co., Wilmington, Del., has been incorporated with a capital of $5,000,000 to manufacture steam-driven automobiles. It is represented by the Colonial Charter Co., Ford Building.

Highway Trailer Co., Edgerton, Wis., sustained a loss of about $30,000 by fire in its main machine shop on July 29, which was the second fire believed to be of incendiary origin within the month. On July 4 the main warehouse and storage building, 190x960 ft., was totally destroyed, the loss being estimated at $260,000. The works of the Continental Axle Co., an affiliated concern, was located in the burned structure. Repairs and replacements of tools will be made immediately.

California Car Co., Oakland, Cal., manufacturer of automobiles and automotive equipment, has plans under way for a new one-story plant. C. R. Manbert, address noted, is architect.

Interstate Car Co., Massachusetts avenue and Sherman drive, Indianapolis, manufacturer of automobiles, has filed plans for a one-story addition to cost about $25,000.

Harrisburg Corp., Harrisburg, Pa., operating the Harrisburg Foundry & Machine Co., Seventh and Curtin streets, has acquired a substantial interest in the plant and business of the Henry, Millard & Henry Co., Inc., 1059-65 West Market street, York, Pa., manufacturer of gasoline engines and tractors, and operating general machine repair works. Plans are under way for enlargements.

H. McFarlane Co., 532 South Canal street, Chicago, manufacturer of wagons and parts, has awarded a contract to the Adams Construction Co., 111 West Washington street, for its new three-story and basement plant on Green street, estimated to cost about $400,000, with machinery. J. L. McConnell, 105 West Monroe street, is architect and engineer. H. F. McFarlane is president.

National Differential Mfg. Co., Takoma Park, Washington, has been incorporated under Delaware laws, with capital of $250,000, by Anthony J. Casel, and George E. Gaylord, Takoma Park, and Joseph B. Simpson, Brightwood, D. C., to manufacture axles and similar equipment for automobiles. It is represented by the Capital Trust Co., Dover, Del.

General Motors Corp., Detroit, has completed the transfer of its Samson motor truck manufacturing operation from Flint, Mich., to the main works of the Samson Tractor Co., Janesville, Wis., where production was resumed August 1. For the present the principal parts will be manufactured at Flint and shipped to Janesville for assembling.

Chapman Carriage Works, Jacksonville, Fla., is having plans prepared for the construction of a three-story addition for the manufacture of automobile bodies and tops, estimated to cost about $100,000, with machinery. Marks & Shettall, Jacksonville, are architects. W. E. Sweney, 332 West Forsythe street, is president.

Houde Engineering Corp., 1392 West avenue, Buffalo, manufacturer of shock absorbers an dkindred products, has awarded contract to William Henrichs & Son, 193 Spring street, for a new two-story factory, 37x100 ft., on West avenue, to cost about $40,000. Ground will be broken at once.

California Car Co., 496 Twelfth street, Oakland, Cal., has leased the plant of the Enterprise Foundry Co., Richmond, Cal., for temporary works, pending the erection of its new plant at Oakland, plans for which are being prepared. The company manufactures automobile equipment and parts.

Severin Motor Co., Oakland, Cal., formerly located at Kansas City, Mo., is having plans prepared for a one-story reinforced concrete factory, 60x450 ft., for the manufacture of automobiles and parts. It is estimated to cost about $100,000 Maury I. Diggs, Easton Building, Oakland, is architect.

Pharo Mfg. Co., Detroit, has removed its business to a plant recently acquired at Bethlehem, Pa., and will continue operations for the manufacture of automobile equipment. The plant at Detroit will be discontinued. R. P. Hutchinson is president.

Bessemer Truck Co., Grove City, Pa., has been incorporated under Delaware laws, with capital of $100,000 by L. M. Monroe, I. M. Lewis and C. G. Keller, Grove City, to manufacture automobile trucks. The company is represented by the Capital Trust Co., Dover, Del.

Adria Motor Car Corp., Cleveland, has acquired the buildings in Evans street, Batavia, formerly occupied by the Gray Tool & Machine Co., for a new plant.

Forth Resilience Mfg. Co., Detroit, has been incorporated with a capital of $100,000 by William Edelstein, W. J. Spearman and Charles Forth, 66 Lawrence avenue, Royal Oak, Detroit, to manufacture automobile parts and other automotive equipment.

Biddle-Crane Motor Car Co., Philadelphia, has been incorporated with a capital of $600,000 under Delaware laws to manufacture automobiles. The company is represented by the Corporation Trust Co. du Pont Building, Wilmington, Del.

Tunison Motor Co., Thayer Building, Oakland, has plans under way for a new one-story reinforced concrete factory, 150x450 ft., for the manufacture of automobiles and parts, estimated to cost about $250,000. It is proposed to begin construction early in the fall.

Daniels Motor Co., Reading, Pa., manufacturer of automobiles, has tentative plans under way for new works at Philadelphia for complete car manufacture, including motors and chassis, estimated to cost close to $500,000 with machinery. George E. Daniels is president.

Acason Motor Truck Co., Detroit, has purchased the property of the David Buick Carburetor Co., Wyandotte, Mich., and will remove its plant to that location.

Denby Motor Truck Co., 49 West Sixty-third street, New York, manufacturer of motor trucks and parts, is arranging for a bond issue to total $600,000. It will also double its capital from $750,000 to $1,400,000 for proposed expansion. The main plaint is located at Detroit.

Franklin Tractor Co., Greenville, O., on the application of a number of its stockholders, has been placed in the hands of a temporary receiver. Fred D. Koppock has been named receiver and it is likely that the plant will be operating under his management.

Martin Parry Corp., Indianapolis, manufacturer of commercial automobile bodies, is arranging for the establishment of new assembling plants at Philadelphia, Pittsburgh, Cleveland, Detroit, St. Louis, Kansas City, Mo., and Newark, N. J.

Hart Quick Change Rim Co., Hart, Mich., has been organized with a capitalization of $100,000 by L. P. Hyde, George W. Powers and Frank Demmon, Hart, to manufacture a new collapsible rim attachment for motor cars.

Adanac Motor Syndicate, Lachine, Que., has been incorporated to manufacture motor trucks, etc. The head office is at 163 St. Joseph street. The directors include Gordon A. Elmslie, H. Milton Purnell and B. H. T. McKenzie.

Cameron Motors Corp., New York, has purchased the implement plant of Cass T. Wright, Greenville, Mich., for the production of parts for the Cameron air-cooled car and Sandusky tractor. About 400 men will be employed.

Six Wheel Truck Co., Fox Lake, Wis., recently incorporated, is now floating a loan for $50,000 for the erection of a building for assembly work, and expects to be in the market for equipment about the first of the year.

Philadelphia Automobile Lamp & Radiator Repair Co., 1304 Callowhill street, Philadelphia, is completing plans and will soon take bids for a new three-story works, 16x95 ft., at 1329 Poplar street, to cost about $30,000.

Blueblaze Motor Specialties Corp., Long Island City, N. Y., manufacturer of automobile equipment, has leased the two-story building on Seventh avenue, near Webster avenue, for the establishment of a new plant.

Belleville Motors, Ltd., Belleville, Ont., have been incorporated with a capital stock of $40,000 by Charles E. Wilmot, Earl E. Chapman, and others to manufacture automobiles, bicycles, trucks, parts, etc.

Personal Mention

B. Edwin Hutchinson has been made treasurer of the Maxwell Motor Corp., having resigned from a similar post in the American Writing Paper Co., Holyoke, Mass., to join the Maxwell-Chalmers interests.

H. M. Schwartze, for 15 years electrical engineer for the Cadillac Motor Car Co., Detroit, has resigned to joint the engineering staff of the new Collins Motor Car Co.

Harvey J. Mallory has been elected vice-president of the Buick Motor Car Co., Flint, Mich., succeeding C. S. Mott, who was recently made chairman of the advisory committee of the General Motors Corporation. Mr. Mallory will also continue his former duties as controller of the Buick company.

F. A. Seiberling, formerly president of the Goodyear Tire & Rubber Co., and now head of the Lehigh Tire & Rubber Co., New Castle, Pa., comprising the plant and business of the New Castle Tire & Rubber Co., recently acquired, is said to have merger plans in preparation for a consolidation of the local works with the Republic Rubber Co., Akron and Canton, O., now operating under a receivership, and the Portage Rubber Co., Akron, in which a substantial interest has been secured. The Republic Rubber plants will be made the principal units in the merger.

Clarence H. Landsittel has been appointed sales engineer for the Climax Motor Devices at Chagrin Falls, O. (near Cleveland). For several years the Climax company has manufactured a complete line of magnet and generator couplings and is now ready to put on the market a single cord disk universal. Mr. Landsittel served as purchasing agent for the Templar Motors for three years and prior to that in the same capacity for the Haynes at Kokomo.

Guy Vaughan, who has been operating the Van Blerck Motor Co. for the past two years as vice-president and general manager on behalf of the George H. Houston management, has been transferred to Philadelphia to the plant of the Standard Steel & Bearings Co. Effective August 8, he assumed his new duties and similar titles with the latter concern which, as one of the Marlin-Rockwell group, is being supervised by Houston and his associates.

A. W. L. Gilpin, who has been manager of the Milwaukee branch and assembling plant of the Ford Motor Co., has been promoted to district manager, in charge of branches at Detroit, Milwaukee, Chicago, Cleveland, Cincinnati, Columbus, Indianapolis and Louisville.

Fred E. Castle, of the Fred E. Castle Co., 1509 Kresge Building, Detroit, Mich., has terminated by agreement, his contract with the Hayes Wheel Co. as distributor throughout the United States of Hayes wire wheels.

E. W. Seaholm, for several years assistant, has been appointed chief engineer of the Cadillac Motor Car Co., Detroit.

H. J. Edwards has tendered his resignation as manager of the Elyria plant of the Willys-Overland Co., thus severing a connection of long standing and high credit to himself. Barring some tentative plans, his future is still undetermined.

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. XLIII, No. 6 NEW YORK, SEPTEMBER, 1921 $2.00 Per Year Issued Monthly

Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City.
Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3, 1879.

The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

Vol. LXIII NEW YORK, SEPTEMBER, 1921 No. 6

Consolidating the Rural School Through the Motor Truck

Recent Trend Toward Better, Larger, More Complete and More Thorough Country Schools Made Possible by the Use of Motor Buses for Transporting the Pupils—Closely Interwoven With Good Roads Also

AMONG the benefits conferred on the country as a whole by the motor truck, automobile and other automotive vehicles, unsuspected even by vehicle builders years ago—and these are many and valuable—is the recent tendency toward the consolidation of the rural or country schools, so that a single, large, well built, well equipped buliding, more nearly of city school lines, serves a large community through the simple plan of bringing all pupils to the school and taking them home again by means of motor buses. Since these large capacity buses are usually built on truck chassis, the credit is given to the motor truck.

Fig. 1. Ten-mile branch school discontinued when consolidated with Caplesville school. Fig. 2 (Center) Old two-room two-teacher Caplesville school. Fig. 3. One of truck-buses used to bring pupils to new consolidated Caplesville school at Caplesville, Tenn.

Getting down to the facts, the following material embodies the results of visits to some 40 or 50 leaders in the consolidated school movement in 13 different states. The advantages of consolidation as it has worked out in these cases will be presented. To a large extent, the period of experimentation has passed and the advantages of consolidation are admitted. The present task is to devise ways and means whereby this shall come to its best form. When this has been done, the movement toward consolidation can be expected to go forward more rapidly, and thus aid in bettering rural conditons throughout the country.

The One-Room District School and Its Defects

The recent awakening in the study of rural life has given to the rural school a new task and a new responsibility. Undoubtedly the greatest educational problem now facing the American people is the rural school. About one-half of the American school children are enrolled in rural schools. Ninety percent of them are getting no other edcuation. These 12,000,000 children are laboring under distinct educational disadvantages, because the 212,000 one-room schools still remaining are of the pioneer type and cannot possibly meet the needs of modern agricultural life.

The school year in some sections is much shorter than it used to be, enrollment is low and daily attendance is often irregular. In recent educational surveys it has been disclosed that in certain states the educational level must be measured by about 6½ years of school attendance for the villages and less than five years for the rural district. How can the intelligent leadership needed so much today upon the American farms be supplied by this limited education?

It is true that these one-room schools have improved

Slightly abstracted from Firestone Ship by Truck bulletin No. 6, entitled Consolidated Rural Schools and the Motor Truck. Cuts kindly loaned by Firestone bureau.

considerably over the schools of 20 and 30 years ago; new subjects have been added and, due to state supervision and pressure, they have been forced to raise their standards. With the increased curriculum the country teacher is now expected to train his pupils thoroughly in the following subjects: Reading, writing, arithmetic, drawing, spelling, history, geography, music, physiology, hygiene, civics, agriculture, grammar, language, domestic science, manual trainng and other industrial subjects. These must be taught in such a way as to fit the various ages and grades of pupils. It is very evident that it takes an unusual person to handle this with success.

As one travels around the country today he is struck with the evidences of prosperity among the farmers. Large and beautiful homes have been built. Adequate barns and sheds have been constructed for the live stock and nothing is lacking in the way of comfort and convenience. The automobile and tractor have replaced the old time cart and plow.

The only institution to remind one of the past is the little district schoolhouse with its ugly, weathered and inhospitable appearance. When Garfield said, "A pine log with the student on one end and Dr. Hopkins on the other would be a liberal education," he uttered it to emphasize the importance of the teacher, but not to minimize the need of a proper house in which the teacher may do his work. The true basis of complaint is not that the rural school has not improved, but that it has not kept and is not keeping step with the onward progress of our civilization. It is a laggard in the race with the city school. While the cities have been, and are still, putting thousands of dollars into beautiful school buildings, equipped with every modern convenience, the country has thought itself well equipped if it had a structure of the "box car" type. Little or no thought has been given to the many things that go to make up a truly efficient school. A one-room school is not necessarily a poor school, nor is a country school by that one fact alone a poor school; but a small school is, and always has been, a poor school. President T. J. Coates of the state normal school of Richmond, Kentucky, in speaking of the small school, said, "The average farmer and rural teacher think of the rural school as a little house, on a little ground, with a little equipment, where a little teacher, for a little while at a little salary, teaches little children, little things."

Fig. 4. New Caplesville consolidated school which replaces three small one-story buildings, serves an area of 25 sq. miles, has 39 high school and 181 public school pupils, made possible by use of motor buses which bring some pupils a distance of 8 miles.

The gravest charge against the one-room school has been its failure to sustain the pupils' interest. This is due to the fact that it is unable to provide the kind of education demanded by the conditions of modern agriculture. Schools that answered well enough a pioneer civilization cannot be expected to do the same for a generation of commercial farmers.

Recent Tendency in Rural Education

It is very generally conceded that the country school, because of its social nature must be the chief means and factor in making country life richer. This the farmer, throughout the country, is coming to realize. Good crops are not of much value to the farmer unless they can provide him with the proper kind of farm life. He is beginning to realize that the best way to obtain these desired ends is to provide his children with the kind of education that will make it possible for them to live in harmony with their environment. This is what the consolidated rural school is organized to do.

In the next 10 or 15 years we shall witness the greatest change in rural schools that the country has ever known. The rural school children of today will be the farmers and farmers' wives of 10 years hence. They will be educated and fitted for their work. The state that falls down in this program of readjustment and fails to effect the most liberal policy possible will be outdistanced in the race. The progressive and enlightened community is going to be the consolidated community.

History of the Movement

Massachusetts, the state that first developed the small district school, was the first to begin consolidation. In 1867 the legislature of Massachusetts passed the first law authorizing consolidation. In 1869 the law was amended to provide for transportation at public expense.

The district of Montague, Massachusetts, was the first to organize under the act. In 1875 three district schools were abandoned and a new brick building erected at a central location, to which the pupils were transported at public expense. This school is still flourishing and serves an area of approximately 20 square miles. A high school department was added soon after the school originated.

While Massachusetts led in the establishment of consolidated schools, as early as 1856 Caleb Mills, superintendent of public instruction in Indiana, urged consolidation. He is sometimes accredited as father of the idea. Little was accomplished throughout the country, however, until the committee of twelve made its report to the National Educational Association in 1896, which report brought the question prominently before the people of the country.

In 1918 the United States bureau of education reported that there were 10,500 consolidated schools in the country. Although there is no way of checking up accurately

since the movement is now spreading so rapidly, the probability is that there are about 13,000 consolidated schools. There are still 212,000 one-room schools, the majority of which resemble the old school of pioneer days; so it can be seen at a glance that the consolidation movement is just fairly under way.

Consolidation in 1920—State Laws

Substantial progress can be made only with the right kind of laws. There are practically as many kinds of laws on consolidation as there are states. The Holmberg act of Minnesota and the Buford-Colley act of Missouri are among the best laws on the subject.

Most states require that consolidaton can come only when the subject is presented to the qualified voters in the districts affected and they vote on it favorably. In the few states where the educational authorities can act without consulting the people, provision is nearly always made whereby the people can force a return to the old order if they are not satisfied. Only a few states, as yet, allow the majority vote of the combined votes cast in all the districts to decide the issue. Too frequently one district can prevent a consolidation which all others concerned want. In most states rural schools may be abandoned by the authorities if the daily attendance falls below a certain number. The remaining students are usually transported to a neighboring school.

In practically all the states pupils are to be transported to the consolidated or centralized school at public expense. In two or three states, as in South Dakota, a certain amount is paid each parent in accordance with the mileage pupils travel, and then each family furnishes its own transportation. Illinois, for a number of years, has had laws permitting consolidation, but just last year (1919) did she amend her law so that transportation could be furnished by the school board at the expense of the district.

Several states not only give aid to help support the school from year to year but pay part of the transportation costs. In Minnesota a consolidated school may draw as much as $4,000 a year from the state for transportation alone. Wisconsin and other states give aid for the erecting and equipping of the consolidated school building. The policy of giving aid is of such recent origin that the full results claimed for it are still to be demonstrated.

Different Units of School Administration

Throughout the country we find three distinct types of school organization—district, township and country. The district, which was the original pioneer organization, still prevails in many parts of the country, especially in the middle western states. The township is the basis for school administration in New England, Pennsylvania, Ohio, Indiana, and parts of Michigan, Iowa, and South Dakota. The county unit has prevailed from the first in the south and has more recently been extended north and westward. The district organization for present day conditions fails to rceognize that education is not solely a matter of local interest but a matter of county and state interest. People no longer remain as much as they formerly did in the district in which they were educated, or failed to be educated. Under it no uniform state-wide advancement is possible. The per capita cost in maintaining the district schools is too high in proportion to the results obtained. For these and other reasons there is very little that can be said in favor of the district.

Survey on Consolidation by States

Most of the consolidated schools of Iowa are of an excellent type. The legal provision for state aid requires a large land area to be used for playgrounds and experimental purposes. This has from the first given the Iowa consolidated schools a decided agricultural bent. Many of the schools are township consolidated schools and have well organized four-year high school departments. It took Iowa 17 years to obtain its first 17 consolidations, but only six years to secure the next 300. During the eight months preceding April, 1920, the number of consolidations was almost doubled. The following is a summary of school consolidation in the state up to April 8, 1920:

380 consolidated schools were organized.
50,000 children have passed from the one-room school to a consolidated school.
10,000 of the above number are in the high school.

Fig. 5. Motor buses for return of pupils to their homes lined up in front of Sargent consolidated school near Monte Vista, Co'. Eight motor buses transport 180 of the pupils, the longest distance being 17 miles.

1,800 have graduated from the twelfth grade this year.
2,500 one-room schools have been closed.
11,000 one-room schools are left.
16 sections is minimum territory that can be consolidated.
88 sections is the largest consolidation to be found
1-6 of the territory of the state is now under consolidation.

Pennslvania, on account of its difficult topography, has made somewhat slow progress in the consolidation of schools. However, some real progress is now being made:

9,875 is the number of one-room schools in the state.
1,320 is the number of two-room schools in the state.
1,715 one-room schools having an average attendance of 12 or less.
552 is the number of townships where complete consolidation would be feasible.
715 rural schools have been closed in last 10 years as a result of consolidation.
684 of the above number were one-room schools.
6,201 pupils are being transported to consolidated schools.
326 vans or wagons are being used for transportation purposes.

Minnesota is making rapid progress in organizing its rural schools to meet the need of present day agricultural life, consolidation being encouraged wherever possible. Some excellent legislation has made the reorganization reasonably easy of attainment, and liberal state aid has provided the stimulus to hasten the work. The Minnesota practice is to consolidate the schools in the open country or on the edge of the rural villages. By the Holmberg act which provides that 25 percent of the resident freeholders may petition for consolidation, and that the election shall be held at one centrally located polling place, the result to be determined by a bare majority of all votes cast, consolidation has not been unduly hampered. In 1909 there were only nine consolidations in Minnesota, while today there are 302.

Colorado, with an area of nearly 104,000 square miles and a population of 709,000, is one of the largest states in the union. Due to its sparsity of population and difficult topography slow progress in consolidation has been made, although there are many locations where it is needed. However, rapid progress has been made recently. In 1917 there were only 20 consolidated schools located in 11 counties in the state while today there are 114 consolidations—to be more exact, 47 consolidations and 67 centralizations. Only 31 out of 63 counties have made any progress at all.

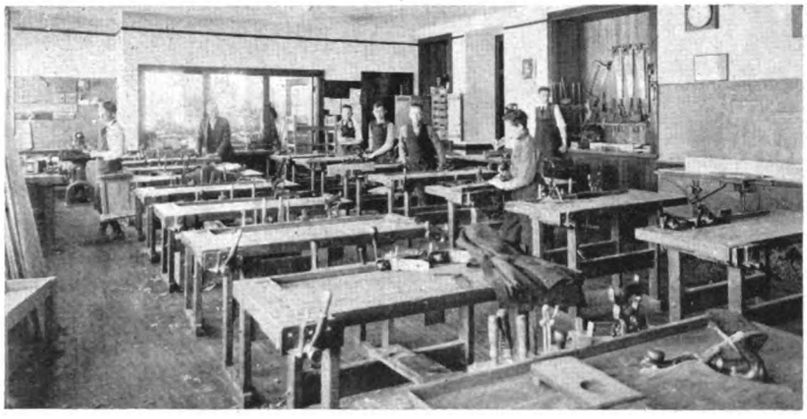

Fig. 6. Manual training department of the Alta, Iowa, consolidated school, which has become the country's social center. It serves an area of 46 sq. miles.

In South Dakota, until the past two years, little progress has been made in consolidation. In 1917 there were only 32 consolidations, most of which were village consolidations, only three being in the open country. Today there are about 140 consolidations and the number is increasing rapidly. Many of the village or town schools have been taking in the country districts for the purpose of getting more taxes.

In Nebraska there is little consolidation. In 1914 Nebraska had 35 consolidated schools. They varied in size from two-teacher to five-teacher schools. In January, 1919, Nebraska had 61 consolidated schools and several more in the process of being formed. The law passed last year, providing for the redistricting of the state into potential consolidated districts, ought to do much in furthering the movement.

Consolidation in Illinois is just getting under way. The school law of last year has cut the bands that have been holding the state back. Already some 50 consolidations have followed the passage of the new law and will be "going concerns" by the opening of school next fall. So far Illinois has only 14 schools that can really be called consolidations, though there are a great many socalled consolidations. In addition to the legal obstacles that heretofore have hindered consolidations, the standardizing and improving of the many one-room schools in the state have somewhat removed the incentive to consolidate. Consolidation in Illinois seems to be coming from the top rather than from the bottom. The popular growth in educational reorganizations has been the creation of a great many township and community high schools of which there are already several hundred. These schools will undoubtedly serve as the nuclei around which the consolidation of the elementary rural schools will be formed.

In Kentucky consolidation of schools is comparatively new. A few progressive centers, such as Mays Lick in Mason county, have made a beginning in an experimetal way. Thus far Kentucky has only 80 consolidated schools.

While North Dakota has not been able to spend money quite as lavishly as many other states, nevertheless it has some unusually fine schools. North Dakota accepts as a consolidation any school that serves 18 contiguous sections and employs two or more teachers, regardless of whether there has been any actual joining of territories. The state now claims 526 consolidated schools, 189 of which are in the open country. According to the standards of some states, many of these schools would not be called consolidations. These schools now have a total enrollment of about 35,000, 3,000 of whom are doing high school work. Probably not more than 300 of the above high school students would be having any training above the elementary grades if it were not for consolidation.

Ohio, in 1892, was the first state west of the Alleghenies to permit the union of two or more districts to form a consolidated school, its first school being Kingsville Township school in Ashtabula county. From this beginning, centralization and consolidation have spread over the state until today there are 909 such schools located in 69 different counties. There still remain 5,880 one-room schools in the state.

West Virginia has established 171 consolidated schools, 20 being organized in 1918 and about 50 in 1919. Approximately 500 one-room schools have been abandoned with 5,000 still remaining. Most of West Virginia's consolidations are small and involve only the abandonment of one, two and three-room district schools. The mountainous character of this state makes it difficult to consolidate the rural schools. Most of the consolidations extend up some narrow valley or along a river, giving to the area considerable length, but scarcely any breadth. With the coming of paved roads up these valleys, consolidation ought to make great strides.

In 1913 the legislature of Tennessee gave the county board of education full power and authority to consolidate two or more schools and to furnish transportation to pupils who live too far to walk to school. This has made consolidation grow rapidly. At the time of passage of this law there were about 150 consolidated schools in the state, but the number has grown considerably since then. Shelby county with 21 consolidated white schools

and 9 consolidated negro schools has gone the farthest of any county in the movement. The area of this county is 743 square miles. It has 1,050 miles of piked roads and 685 miles of graded roads. These road conditions have favored rapid consolidation. Consolidation in the white schools is just about completed, there being 14 nonconsolidated schools left, most of which are kept up for the lower grades within the consolidated areas. Transportation to the extent of 43 horse hacks and 20 auto busses is furnished the white schools of the county. The average size of consolidations in Tennessee is 14 square miles.

Although Missouri has excellent laws permitting consolidation, very little has been accomplished. In 1914 there were only 29 consolidated schools. The prevalence of the many clay roads and the existence of the old district unit system in the state seem to explain why so little has been done. There are probably 150 consolidated schools in the state today, 130 of which maintain high schools—while there still remain some 9,000 one-room schools.

In 1896 Kansas established its first consolidation. In 1914 there were 75 consolidated schools and today there are approximately 140, although many are consolidations more in name than in fact.

Wisconsin has agitated consolidation during the past few years and several consolidations have resulted. There are over 6,000 one-room schools in the state and many of them would be greatly benefited by consolidation. Wisconsin now gives aid for erecting and equipping the consolidated school building, and also annual aid for transportation. With these inducements, consolidation ought to progress throughout the state very rapidly.

The Hoosier state with more consolidations than any other, has made an enviable record. A 30 years' campaign for the consolidation of rural schools in Indiana by state educational leaders has resulted in reducing the number of one-room schools in the state from 8,853 in 1890 to 4,880 in 1920. The total number of one-room schools abandoned in favor of consolidated schools is 3,973. In 1912 there were in the state 589 consolidated schools. Today Indiana has 1,002 such schools and is said to be 45 percent consolidated. There are about eight counties that are over 90 percent consolidated. Randolph county, leading them all with 97.7 percent, has only three one-room schools remaining out of an original number of 131.

Throughout the country there seems to be a general tendency toward consolidation. In this connection the report of the United States commissioner of education for the year ended June 30, 1919, is interesting: "There was a steady extension during the year of the consolidation of one and two-teacher schools. In spite of the additional cost of buildings and equipment many states strengthened the existing laws for consolidation in various ways. The trend is toward substantial encouragement, generally in the form of state aid. Georgia, for example, passed a law giving $500 to $1,000 from state funds to each consolidated school, according to the number of teachers employed. Pennsylvania pays half the cost of transportation from state funds; Washington increased the state apportionment to consolidated schools employing a superintendent or principal. Some states passed laws legalizing the expense of transportation. Oklahoma gives to consolidated districts an amount equal to one-half the cost of a three or more room building up to $2,500.

The Typical Consolidated School

The aim of the typical consolidated school is to meet the educational, social and economic needs of the community in which it is located. It is distinctly rural in atmosphere and is often to be found situated several miles from any town or village. It has a larger enrollment than the old one-room school, and serves a much larger territory, the average ranging from 30 to 50 square miles. Pupils are transported regularly at public expense by a rapid and safe method usually by motor busses or large capacity automobiles.

The building of this typical school is a large, substantial structure of stone or brick, planned not only for utilitarian purposes, but also for architectural beauty. It is usually to be found near the center of a four or five acre school site, surrounded by cement walks, shrubbery and well-kept lawns. To the rear of the building are to be found all sorts of recreational and playground equipment. And, in a great many cases, the school has set aside an acre or two as a working laboratory for experimentation in agriculture. It has every convenience that can be found in city schools. The people become identified to such an extent with the school and its interests that frequently, when speaking to outsiders, they mention it and show the great part that it is playing in their community life.

Fig. 8. General view of Alta consolidated school, where motors help transport 220 of the school's 464 enrollment.

The typical school is ordinarily in charge of about 10 or 15 professionally trained teachers and offers not only a well organized course of work for the elementary grades, but usually has a four-year high school course. The better and more influential school is the school offering a complete high school course of study. The equipment of this school for teaching physics, chemistry, agriculture, domestic science, and manual training is complete.

The consolidated school building is constructed for a broader purpose than merely a school building. It contains a large auditorium that will accommodate any average gathering of the people and becomes the center of community interests and life. It brings about a closer relation between patrons, children and the school, and this alone is well worth the extra cost of an auditorium. Around the school are centered many activities such as the lyceum course, the farm grange, the farmers' insti-

tute and community entertainments. These activities center about the typical consolidated school and make it indispensable in the new agricultural life of today.

Advantages of Consolidation

The consolidated school has demonstrated that it has advantages and offers educational opportunities that the one-teacher school does not offer. Some of the chief advantages are:

1. The consolidated school is a large enough school to warrant the services of a competent superintendent.

2. Invariably the transportation of pupils to the consolidated school has resulted in a larger and more regular attendance and has eliminated tardiness.

3. Children are no longer compelled to wear wet shoes all day after walking through rain and mud. Thus, health is conserved.

4. A higher appreciation of school work in advance of the eighth grade is produced. More go to high school. In Randolph county, Indiana, where there are now only three of the original 131 one-room schools left, a total of 1,215 students have graduated from the eighth grade during the last five years and 1,179 of this number have entered high school, showing a record of 97 percent. Before consolidation there were only 61 students in high school from all the one-room schools in the county; after consolidation there are 742 and the rural population today is practically what it was formerly.

5. Pupils can be better grouped into classes on the basis of advancement

6. The student's time can now be divided much more effectively between study and recitation.

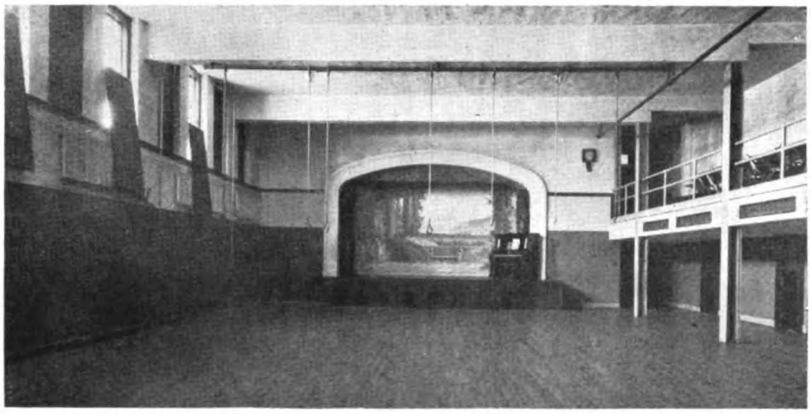

Fig. 7. Auditorium and gymnasium of Alta, Iowa, consolidated school; the community's social center, made possible by use of motor buses

7. There can be a greater vitalization of the school work by more courses, such as music, manual training, domestic science, agriculture, drawing and sanitation.

8. The contact with a larger number of children broadens the child's vision and gives a more enlightened viewpoint. It also has the same influence on the whole community since the consolidated school stimulates community meetings and a better cooperative spirit.

9. Teachers of a higher calibre are attracted to the consolidated school and the teaching force is much more stable.

10. The large number of acres and people gives a more satisfactory taxing basis.

11. The consolidated school offers a greater equality of educational opportunity. Under the old one-room system the children of the poorer district did not get as good an education as those of the more wealthy districts.

12. The consolidated school makes possible better school rooms, better light, heat, ventilation and sanitation.

13. The morals of the pupils are protected in going to and from school since they are in the care of a trustworthy driver.

14. The consolidated school provides amusement and entertainment in community games and sports, moving pictures, musical festivals, school exhibits, picnics and parties. All this gives a variety and charm to country life that is too frequently lacking.

15. Consolidation develops a broad functioning. Young people learn to have more confidence in themselves and seek a greater participation in the activities of the community.

16. Consolidation develops in the community powers of leadership. The directing force is a superintendent who should be a man of experience and mature judgment with an appreciation of the ways and opportunities of country life. He will organize the community for cultural growth and material progress.

17. The course of study is particularly adapted to the child's environment. Since the majority of the boys and girls who attend remain on the farm, the instruction of the school emphasizes the kind of education that will prepare them for the life they are to live.

18. The consolidated school gives to the country child all the advantages of a city school without sacrificing the advantages of rural life.

19. The consolidated school operates in such a way that it sustains the interest of the pupils, especially the boys.

20. Last but not least, the consolidated school goes a long way in meeting tht one big cause of the boy deserting the farm—the desire and want of association. The county superintendent of schools of Butler county, Iowa, recently made a survey of 56 consolidated school districts in Iowa. Of the farmers who were asked if they would change back to the old way, 160 replied, "Yes"; while 1,166 were not willing to return, showing that about 90 percent of the farmers are entirely satisfied.

The following facts furnished by the county superintendent of Preble county, Ohio, show what consolidation has done for that county:

County	Before consolidation 1914	Since consolidation 1917	Increase
School property	$374,925	$601,120	60%
Volumes in school libraries	14,881	20,836	40%
Enumeration of school youth	5,135	5,076	less
Total enrollment	4,374	4,508	3%
Total enrollment in high schools	523 (1920)	812	55%
School buildings used	108	52	less
One-room schools in use	92 (1920)	23	less

Consolidated schools with high school	1	(1920) 13	1200%
Wagons carrying children	10	91	810%
Teachers graduates of college or normal	16	63	300%
High school graduates	112	122	9%
Eighth grade graduates	168	285	70%
Pupils in domestic science work	121	392	224%
Manual training	61	155	154%
Value of exhibits at county fair	$25	$800	3100%
Educational hall provided	no	yes	
People present at annual county play day	none	3,000	
Entries at county play day	none	1,494	
Different pupils entered county play day	none	524	
Teachers			
Teachers who are college graduates	13	28	
Teachers who are normal graduates	3	35	
Graduates of first-grade high school	98	124	
One-year certificates	89	52	
Three-year certificates	16	56	

Cost	Subdistrict No. 10 Washington township (Not consol.)	Monroe township (Consol.)
Average annual cost per pupil for tuition and transportation	$50.90	$37.62
Average daily attendance	80%	92%

(In Somers township)

Number attending community meetings in county:

1919	No.	Receipts
September	1,521	$90.00
October	4,549	603.00
November	8,286	721.00
December	9,093	771.00
1920		
January	4,514	298.00
February	5,655	617.00

The county superintendent of Randolph county, Indiana, offers the following data on consolidation:

Number of one-room schools	131	3
Number of first-grade township high schools	1	16
Number of township pupils in high schools	61	742
Number of grade teachers	154	86
Number of high school and special teachers	3	62
Percent of eighth grade graduates in high school	21-50	97

8th grade graduates, '15	240	Entered high school	230
" " " '16	242	Entered high school	231
" " " '17	253	Entered high school	243
" " " '18	232	Entered high school	227
" " " '19	248	Entered high school	248
Total	1215		1179

Number of pupils transported in 1918-19	3126
Number of horse-drawn hacks	102
Number of motor busses	28

No expression of the benefits from consolidation is worth as much as that which comes directly from taxpayers who have had experience with consolidation. Mr. A. Newton of the East Chain consolidated school district in Martin county, Minnesota, states:

"Consolidation, good roads and local improvements are not for speculators and nonresident land owners, as their chief interest is high rent and low taxes and letting the community get along as best it can. But for local land owners and renters who have boys and girls to educate, consolidation is the coming thing.

"Transportation is one of the big problems in a consolidated school, and the school will not be successful unless it has successful transportation. I live 2¾ miles from the East Chain school and ¼ mile from the road. The statements about the inconvenience and long waits in the snow are a joke, because how about wading two or three miles to a one-room school and a cold one at that.

"We can see the bus coming and the telephone also keeps the patrons informed when it will arrive. In our system the farthest anyone has to walk is ½ mile, and an adjustment is now under consideration so the bus will pass his house.

"My boys would have stayed home half the winter had I sent them to a one-room school and what would they have gotten out of it in a school where a teacher has to be a jack-of-all-trades and teach eight grades besides?

"Transportation has proved successful and can be made more successful. As our roads get better from year to year, our transportation will reach a higher degree of perfection.

"I came to East Chain because they were talking consolidated schools and I voted for the consolidated school because I have three boys and a girl. Above everything else, my ambition is to give them a good education. Taxes may be somewhat lower in other townships, but I wouldn't trade my quarter section for the best one in Martin county if I had to go back to the one-room school, and I think this expresses the sentiment of the majority in East Chain township.

"We think just as much of our boys and girls in East Chain as you do in town and why shouldn't we tax ourselves to keep them at home and give them the same opportunities here as you folks do in town. If we do not, the better class will move to town to give their children these opportunities and the indifferent, careless class will be left in the country. Our cities and towns are overpopulated now. We must offer more opportunites on the farm to keep the boys and girls on the farm. If we can afford six-cylinder automobiles, we can also afford the better kind of schools."

It is learned through Vice Consul Donoghue at Singapore, that permission has been granted to the municipal engineer to build one or more roads of rubber to determine whether this product has more enduring qualities than laterite and other road materials. The municipal engineer claims that a road built of rubber in England 45 years ago is still in as good condition as when laid. In the past it has been the custom to vulcanize the rubber onto steel plates measuring 9 by 3 inches, but it is thought that to vulcanize the rubber onto concrete piles will prove as durable and be much less expensive.

Modern Upholstering for Motor Cars -- II

The Enclosed Model, and the Special Forms of Trimming Used Therein—Special Materials—Special Accessories and Their Influence—Other Details

WHILE it is a true statement that not all buyers of enclosed cars are numbered among the wealthy, it is a fact that originally all enclosed cars were of the expensive type, and even today a majority of the enclosed body forms are on expensive chassis. As the vogue of the enclosed car spreads each year this becomes less and less true. An eminent body engineer has said, "Those who produce cars in large numbers for this class of trade (purchasers who are able to buy without counting the cost) usually follow a design that is not extreme, and that relies for its attractiveness upon the fine quality of the workmanship and the high quality of the materials used."

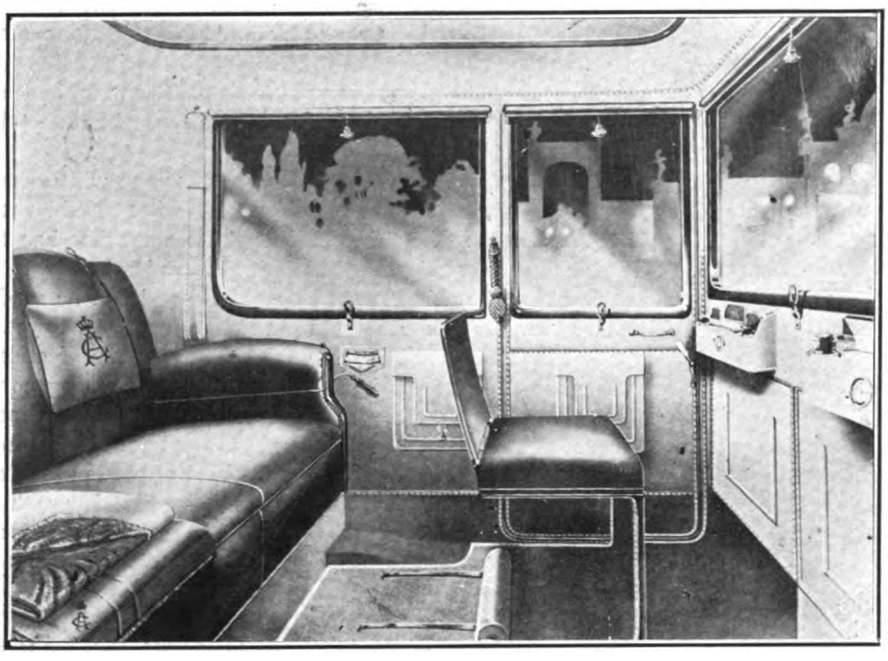

Fig. 8. Interior of Mercedes (German) enclosed car, showing sofa-type of rear seat with smooth upholstering. Note lace trimming around doors, extra seat cover panels and elsewhere.

This applies particularly to the upholstery, both as to materials and workmanship on the one hand, and design or type on the other. Consequently, we generally find a fine landaulette or limousine beautifully upholstered and with all the details worked out in a correspondingly fine manner. Considering now the single landaulette with its two folding seats, the front seat and inside would be upholstered in half diamonds (as described in detail in the previous or August issue, on pages 7 to 11), also the squabs and would be trimmed in leather, with cloth head lining, speaking tube, small mirror and other accessories. The head is usually a square one, the roof closing above the hinge pillar.

For this type of body the materials needed are: One large enamel hide, 2½ hides of buffalo leather, 1¼ gross of buttons, 3¾ yards of cloth, 1½ yards of common felt, 2 yards of black linen, 4 yards of double width sailcloth, 2½ yards hessian canvas, 16 springs of 5-inch 14 gauge wire, 8 springs of 7-inch 12 gauge wire, 24 yards of pasting lace, 30 yards of seaming lace, 4½ yards close edged broad lace, 4 frog ends, 4 glass string slides, 4 knobs, 4 glass string plates, 4 door step plates, 1 speaking tube or telephone complete with fittings, 1 roof pull, 2 door pulls, 1 small mirror, 1 card tray, 1 cigar tray, 20 pounds of horse hair, 6 yards of best webbing, 18 yards of common webbing, and 3 12-foot lengths of ⅜-inch rough brass bead.

Proper Body Support Important

If the body is not on the chassis attention should be paid to see that it is resting squarely and true on the trestles or other supports; this is most important with all closed bodies which have a folding head. Having attended to this, the body is ready for setting up the head, using the best webbing for this purpose. The back-stick should be dropped about ¼ inch lower than the line of the remainder of the roof and should have ¾ inch sail to the upright square of the back of the body taken at the point where the head leather is fixed to the top rail. It is necessary that the two top corners be true to the body; having this correctly done fix two wooden slabs on either side about 6 inches in from the edge. These are necessary to keep the head firm and true while fixing the head lining. Cut out the cloth to suitable sizes, being careful that the roof pieces brush forward and the back and quarters downward. In a body of this type both quarters will usually come out of the width, otherwise another ¾ yard of cloth will be needed.

Next mark the center of the back and front sticks, tack up the hind roof piece, mark the center on the cloth back and front, the sides back and front, and center sticks also at these points mark the front of front stick, center of center stick and back of hind stick. The roof can then be taken down, and the quarters fitted, marking along the top to correspond with the sides of the roof, also marking where the opening of the head at the hinge will be; the cloth being cut at this point will be bound with lace cloth or morocco. The back piece should be fitted next, at the same time marking along the top, and at points at each top corner and also in the center. Next take a piece of seaming lace long enough to go up each side and along the back stick, fit this to the top of the back stick, marking same to correspond with the marks on the back pieces of cloth. These remarks it will have been noted by this time, follow British practice, much of this material having been abstracted from the pages of Cooper's Vehicle Journal.

How to Make Up the Head Lining

When making up the head lining it is advisable to sew the back piece of cloth to the previously mentioned piece of seaming lace, being careful to keep the marks on

the lace and cloth corresponding. Then sew the quarters to the roof piece with seaming lace in the seam, after which sew the back to the quarters, leaving just a little bit at the top, about 2½ inches, which should not be sewn to the roof at all; this completes the making up of the lining.

Before fitting the canvas for the squabs, the lace lines must be decided upon; these consist of the top lace lines along the top of the quarters and across the doors and the inside front, also the bottom line of the doors and quarters, which is carried to the same height on the inside front, if possible. It is important with regard to appearance to note that the top line should continue at one level all around the body. This being properly arranged the canvas should then be fitted for the squabs. The front seat is trimmed with a separate back and quarters, the tops of the latter being finished roll-over style.

Lay Out the Front Seat Quarters

Mark out the quarters for half diamonds 3½ inches wide and 4 inches deep. Usually there is only depth enough for two rows of buttons; the back squab is marked out 4 inches wide and 4½ inches deep with a suitable depth of swell. Allow for fullness for the quarters, 1 inch across and ½ inch between top and bottom half diamonds; for the back allow 1½ inches across and ½ inch between top and bottom of half diamonds and bottom button line.

For the inside of the body fit canvas for the quarters and back, also the doors. In this case the quarters will have three rows of buttons, otherwise mark out the canvas for quarters and back in accordance with procedure adopted for the front seat, and for fullness in the material used, allow for the quarters 1 inch across, ¼ inch between the top button and bottom of the half diamond, and ¼ inch between the bottom of the halt diamond and the bottom buttons. The fullness for the back is 1½ inches across, ¼ inch in the half diamonds, and 1 inch between the bottom of the half diamonds and the bottom buttons for the swell. Mark out the doors to match the quarters, but no fullness need be allowed between the bottom of the half diamonds and the bottom buttons.

All pleats should be machine sewn and stuffed up on the bench, with the exception of the door squabs; these can be stuffed on the doors. Then sew up the back edges of the quarters and the ends of the backs. One row of springs should be used in the front seat and two rows in the back. The front squabs can be fixed straght away, but the head lining should be put in first before the quarters and back squabs are dealt with.

Fixing the Head Lining in Place

Before putting in the head lining, it is helpful to fix some pieces of odd seaming lace between the sticks along the top corners; this is to lace up the seams of the lining. Also a piece of list should be fixed along the center stick and a piece of calico or black linen in the quarters. The lining can then be fastened in; nail the two top back corners first, then pull the seams forward and secure the two front corners, stretch the roof into place, back and front, subsequently nailing the top of the back into its place. Attention should be given to keeping the lace neat and straight, then lace up the seam at the top of the quarters with twine to the pieces of seaming lace already nailed in; do not tie off this lacing yet, but leave it for adjusting afterwards. The quarters should then be stretched into place, care being taken to see that the bound cut of head cloth at the hinge centre is accurately in place; the lacing can then be adjusted along the top so that the seam is neat and straight; stretch the seaming lace down the back of the quarter and secure into place, but leave the sewing up of this back seam until after the squabs are fixed in. The quarter squabs can now be fixed, the top stuffed up and seaming and pasting laces fixed along the top, after which the back squab can be fixed and finished off with laces; then finish off the back of the head lining, first nailing down the back cloth and sewing up the seams and across the centre stick.

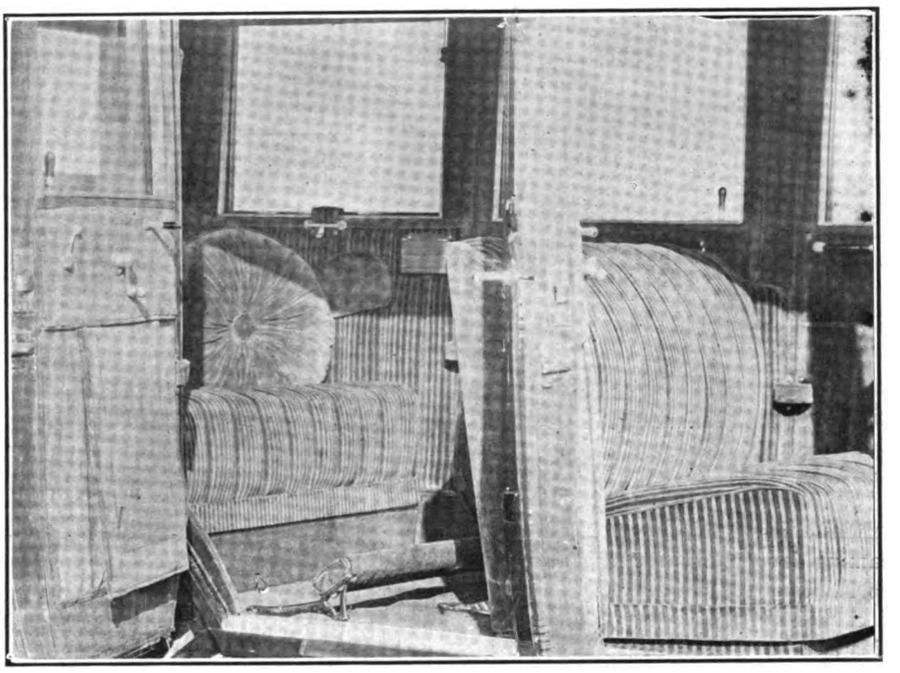

Fig. 9. American (Stephens) enclosed car upholstered in a striped velour in straight pipes without buttons. Note cushion and arm rests, also window pulls, upholstered to match.

The Roof and Doors

The door welts should be pasted up at the beginning of the job, also the glass strings, hand holders and door stops, so that they will all be dry and ready for use when required; the door stops should be made up with a double thickness of broad lace, and with double webbing of best quality in between; when dry, machine sew all these down each edge, and when the welts are ready they should be nailed into place, also paste a piece of cloth along the top rail of the inside front, and fix up the front roof.

This will look neater without pasting lace, only seaming lace being used; the following way will commend itself as eminently practical—sew a piece of seaming lace along the front of the roof cloth, leaving the lace long enough to go along the sides, back tack the front edge of the roof with the tape edge of the lace turned upwards, then nail the lace into place along the sides, pulling the

cloth towards the back and fix with a few tacks, then sewing the sides of the cloth into the seaming lace with a bent needle; secure the back edge and finish this off with seaming and pasting lace. A pillar piece for the hinge pillar should be made up and fixed into place, filling it out with a strip of wadding.

The inside front is trimmed plain and padded with felt and wadding, one thickness of each; paste on a piece of felt large enough to cover the board, between the top and bottom lace lines, leaving a margin each side sufficient for the seaming and pasting lace; cover with wadding, then stretch over the leather and fix same, with seaming lace along the top with the tape edge upwards; back tack a strip of leather along this lace, wide enough to cover the waist rail, and nail along the top.

The best method to fill out this rail is to fix a piece of concave shaped board, about ⅝ inch thick along its centre, with the ends tapered off; screw this in and cover with wadding and pull up the leather and fix along the top of the waist rail.

Proceed next with the doors. Fix the squabs into place, and stuff them on the doors as previously recommended; finish off the squabs all round with a piece of seaming lace along the top and finish off the waist rail the same as the inside front. It is well to paste a piece of carpet on the bottom of the door and finish off the sides and bottom with pasting lace only. The doors need not be trimmed above the waist rail.

Put in the carpets in the bottom part of the body, and complete the whole with pasting and seaming laces down the hinge pillar, along the rockers and up the sides of the inside front. In some cases the head lining is carried over the front rail and fastened under the water plate, otherwise this should be finished off with seaming and pasting laces in the same way as the corresponding edge of the front roof; also fix seaming and pasting laces down the shut pillar of the head.

The valance board can then be fixed and covered, the seat board also should be covered, also fix all furniture and hand holders. The cushions are made up in the stuff over style as explained in the August article, either with squares or half diamonds. The front doors can be trimmed in accordance with either of the methods already explained, the front seat being finished off with piping and beading.

It is usual for the tip-up seats to be trimmed quite plain, and made up in the following manner: A roll all round the seat, about 1 inch high, with the centre of the seat filled up with hair; cover this with calico and regulate, then cover again with leather, fixing this all round and cover with leather, finish off with seaming and past- the edge of the seat; put a layer of hair on the bottom ing lace round the edge.

Fixing the Head Leather

Finally the head leather is put on; this as a rule will test the capabilities of a trimmer; if the best results are to be obtained care must be taken not to get the head out of truth, also that it will shut and lock properly. The preparations generally made are to nail a piece of best webbing along the outside top corners of the head, stretching very tight, to form a square corner with the webbing on the top; sew the edge of these webbings together with strong thread, stitching with over and over stitches spaced at short intervals, then paste a strip of thin felt, about 1½ inches wide, along this, sew edge to give a smooth appearance; any old piece of felt may be used up for this job; then put in some tacks for marking points along the sides of the roof about 2 inches in from the edge, and in the centres of back stick, centre stick and front rail.

The head leather can now be fitted. First take rough paper patterns of the roof, back and one quarter; allow all round just enough to work comfortably, about 1 inch; lay out upon the enamel hide and cut out to the best advantage; usually the roof will come out of the neck, the back along one side, and the two quarters on the opposite side. Stretch on the quarters first, being careful to cut the holes for the props in the exact place required, when the leather is stretched satisfactorily in place; tap with the hammer at each marking tack, and mark with a pencil on the back of the leather the exact position of the top back corner and bottom back corner, and mark exactly where the cut is required at the hinge of the head (if this cut is very large it will be best to back it up with a piece of thin black leather and welt it, but if only a small cut, backing and just plain sewing will be sufficient).

Then take a chalk line and mark along the seam of the roof, taking up the full tack head, if the seam is to be sewn through and through, but only half the head if the seam is to be closed; then fit the roof, marking for the seam in the same way, and lastly the back, marking the top back corner and bottom corner in the same manner as the quarters.

After the fitting, the parts are worked up on the bench, the back is creased down each side, and with a suitable sweep mark the back seam on back and quaters; sew this seam with basting stitches, or stick together with rubber solution and welt, then sew the roof seam strongly with a strong wax thread about six stitches to the inch.

(Concluded on page 28.)

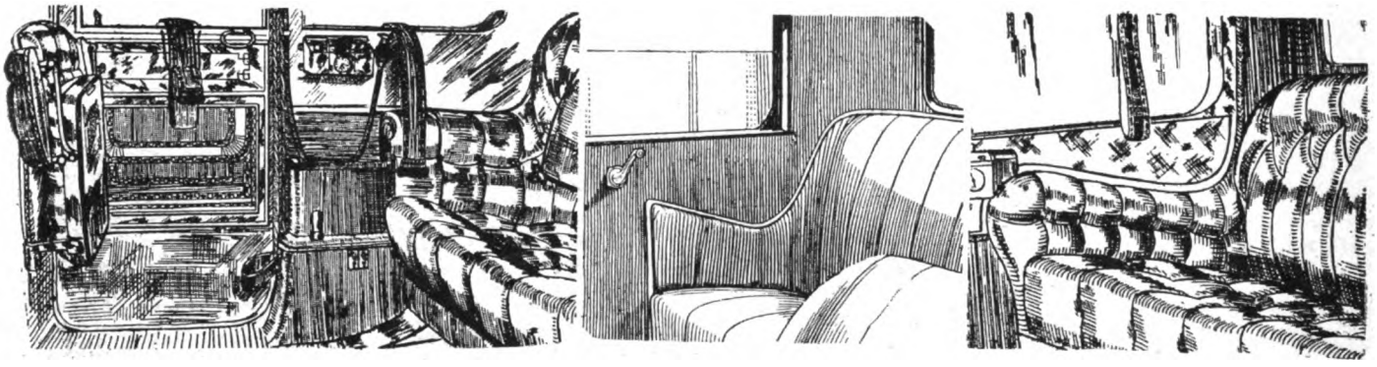

Fig. 10. Other enclosed cars carrying out the sofa-type rear seats. At left, D'Ieteren (Belgian) with square tufted leather. Center, Paige straight piping without buttons. At right, Mann-Egerton body on Armstrong-Siddeley chassis has pipes and half diamonds for back squabs, square tufts for seat and quarters.

Automotive Industry Doing Share of Reducing Living Cost

Industry Showed Lower Increase in War Time Than Many Other Basic Commodities, and Relatively Greater Recent Reductions—Some Data

ABUSE of the automotive industry has become quite the fashion, and the freest kind of criticism of it continues with little change. When the bottom fell out of the iron and steel market due to the continuance of war prices two and three years after war conditions ceased to exist, the "wicked automobile makers were to blame." When money had to be raised in tremendous amounts for the profligate wastes of the shipping board, and other national bodies located at Washington, the extravagance of the people was condemned as responsible for the continuing high taxation, and as proof of this it was shown that "the people were continuing to buy millions of dollars' worth of automobiles." In recent months it has become quite the fashion to blame the automotive industry for all of our larger ills.

As W. C. Durant, one of the leaders of the industry, said to the St. Paul Automotive Trades Association a few weeks ago, "The automotive industry, the largest in this country, has been 'kicked around the lot' quite long enough. It is suffering severely today—and the national government is doing very little to improve the situation. Let the automotive industry take the lead in a great natonal industrial corrective movement."

Along similar lines were the remarks made at about the same time of Emory W. Clark, president, First and Old Detroit National Bank, Detroit. He said, "The motor industry is the strongest factor today in industrial restoration in this country. The motor industry is today the leading industry in the United States in the number of persons employed and in raw material consumed, and is, therefore, supporting more persons during the period of general business depression than is any other. The last few years have demonstrated that motor cars are more of a necessity than clothing and many food products. Many a man has been able to get along without buying new clothes and has curtailed his consumption of food luxuries—but has not hesitated to invest in a new automobile or to repair the old one so necessary to his daily life. The farmer had no money with which to buy farm implements and machinery, but he has been buying the automobiles necessary to his daily life."

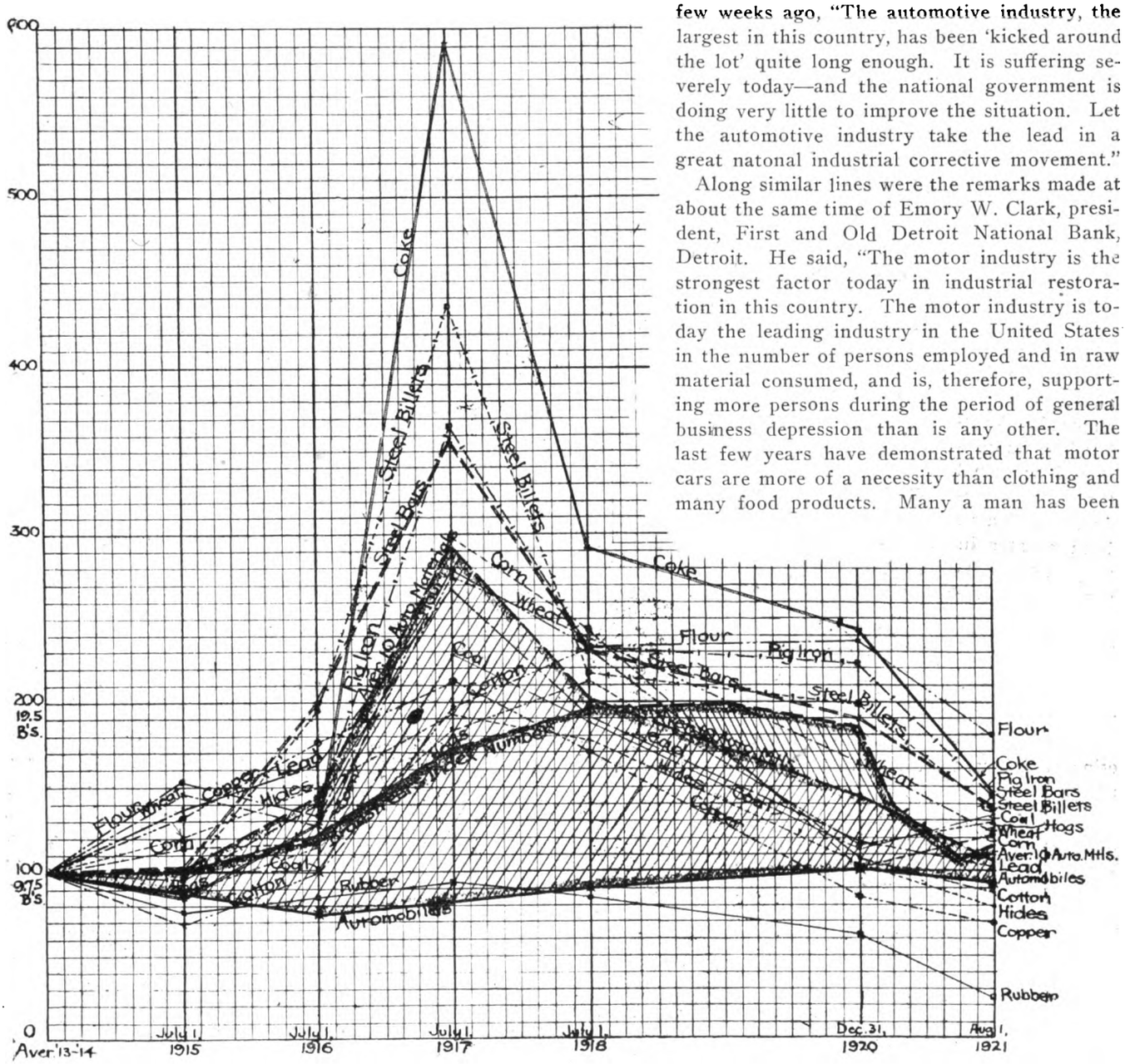

Fig. 1. Chart showing variation of prices of fourteen principal commodities, and raw materials, as compared with automobiles in years 1913 to 1921

"A report from Pittsburgh advises that recent orders for steel coming from the motor industry are the prin-

cipal factor in setting some of the Pittsburgh mills in operation at 50 percent of capacity."

"The motor car industry is unquestionably as stable an industry as we have today and one of the largest contributors to our national welfare."

One of the automobile papers quotes the newspapers which point out that the automobile is being blamed for the increase in crime all over the country, because "the automobile, on account of affording a quick and easy get away, is the main factor in the current crime wave, and the greatest aid to hold-up men." As a matter of fact blame of this kind is silly, for the criminals have simply shown good judgment in using what is the quickest and most mobile method of transportation. It would be just as unfair to blame the manufacturer of firearms for the crime wave, or for that matter, the manufacturers of the steel from which the firearms are made.

It will be the purpose of the following pages to show, primarily along price lines, that the automobile has been a product which has been decreasing constantly in price, in contrast with many other commodities, until the war increases in labor and raw materials forced prices upward; that when such upward turn became necessary, the increase was relatively less than any usual commodity or raw material, even less than the raw materials entering into its construction; and that recent reductions have been greater in proportion to its previous war increases than any other commodity or raw material, in fact that throughout its price ranges in recent years, it has shown a relatively lower and more consistently lowering price level than any other item, commodity or product which is in widespread daily use.

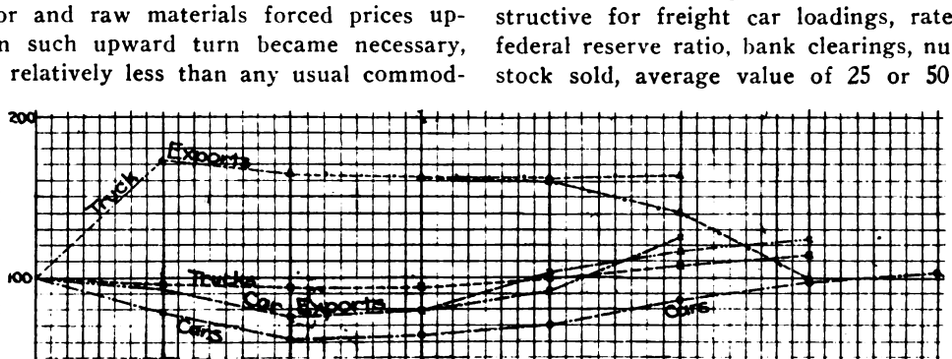

Fig. 2. Chart of variation in automobile and truck domestic and export prices from 1913 to 1921

To assist in presenting these ideas, some charts have been prepared and are presented herewith. The larger chart, Fig. 1, shows the variations in the prices of seven principal commodities and seven raw materials, as well as in motor passenger cars, practically from January 1, 1913, to date.

The prices from July 1, 1913, up to June 30, 1914, were averaged and the resulting price taken as the basis or 100 percent. As prices rose subsequently, they became more than 100 percent, as the table shows, and as prices became lower than this assumed standard they became less than 100 percent. The actual figures are given in the accompanying Table I, while the values have been plotted in the chart.

The commodities selected include corn, wheat flour, hogs, wheat, cotton, hides and rubber. Meat would have been preferable to hogs, but complete figures were not available, similarly the inclusion of wool would have been desirable but the figures were not complete. While it might be thought that wheat flour and wheat were too close together to warrant using both, inasmuch as the price of flour is dependent almost entirely upon that of wheat, the actual figures and plotted curves show that such is not the case, wheat being higher than flour in 1918, and much lower in 1920.

The raw materials selected include ingot copper, lead, bituminous coal, coke, Bessemer pig iron, basic steel billets and steel bars. It might have been desirable to include zinc, brass, cement, and so far as automobile manufacture is concerned, steel sheets in the most used forms, some of the widely used alloy steels, an average of machine tool prices, and some other items, but as in the other cases mentioned, the figures were not available.

The heavy dash and dot line is Bradstreet's index number of average prices. This indicates some thirteen groups of materials, and is a duplication of other figures in that some of the commodities and materials plotted separately are included in some of its groups. However, it gives a better average value than anything else available.

From a standpoint of making this table and chart a cross section of the whole business of the United States in all lines, similar figures and curves would have been instructive for freight car loadings, rates on call money, federal reserve ratio, bank clearings, number of shares of stock sold, average value of 25 or 50 selected railroad and a similar number of selected railroad stocks, total bond sales, totals of building permits issued, other industrial index numbers, and other similar general information. It was felt however that adding all this information would make the table and charts so bulky as to spoil their usefulness in large part. Consequently the number was deliberately kept down as small as possible.

The chart very plainly shows, and the tabular figures confirm, what everyone knows, namely that prices in general started to rise slowly in 1914-1915, so that by the first of July, 1915, some groups have risen a considerable distance. Especially was this so of the nonferrous metals, corn, wheat, flour and hides. The products of these lists which entered into automobile construction, either directly or indirectly, averaged 101.6. Automobiles on the other hand were continuing along the lines laid down before the war, that is were constantly being reduced, and in spite of the increase of the constituents used by 1.6 percent, had been reduced on the average (taking all makes and models) by slightly more than $900, so that the figure stood at 74 on Jan. 1, 1916, and 1915 by average would be about 87. These January averages have been plotted as though they were of July 1 of the same year in order to make the chart uniform. That is while raw materials and semi-manufactured products were going upward in a considerable amount, the prices of finished motor cars was being reduced by a very large amount, comparatively.

In the next year, 1915-1916, the upward swing of both

commodities and raw materials was even more marked, everything in the list having passed the initial 100 mark, except rubber at 85, and cotton right on the mark at 100. All the materials listed had increased in price so that the average was 137.8, and the average of the ten used in automobile construction was even higher at 143.5. Despite this very heavy increase, automobile prices had declined as given previously to 74.

The Bradstreet figure shows little upward movement in 1915, because it includes such a large number of materials, many of which had not yet felt the war pressure. In 1917 however it shows quite a smart upturn although but half that of the ten automobile materials. These curves would seem to show that the irons and steels were increased out of proportion to all other materials.

By July, 1917, the increases had continued until twelve of the list were more than twice the original price, and of these five were more than three times as much, two more than four times as much, and one nearly six times the pre-war or normal figure. One year later automobiles had only reached a figure of 90, so by averaging the figure for this period was but 82. That is along the average of the materials used was nearly three times the pre-

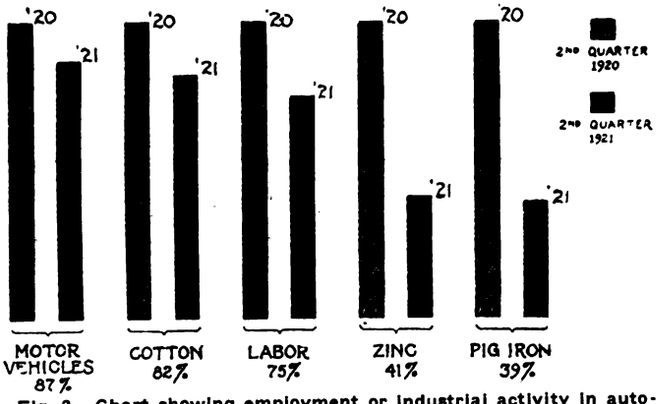

Fig. 3. Chart showing employment or industrial activity in automotive as compared with other prominent industries.

war standard, automobile prices were just beginning to go up, and had not yet increased to within 18 percent of the pre-war average.

That year saw the peak of the war prices of materials, so that the following year showed an almost universal decrease. By July 1, 1918, the whole list was up to an average of 210.3, and the ten used in motor car construction up to 201.6. As stated automobile prices had begun the upturn but had only reached a figure of 90. From this it can be seen that the tremendous prices of materials and parts had forced the automobile manufacturers to make increases, but their increase was almost infinitessimal compared with the increase in the products listed.

The Bradstreet index however was still moving upward, this continuing into 1919 when it reached its high level, the actual high point being in the month of February, 1920 (not shown on the chart). The last year, that is from Sept. 1, 1920, to Sept. 1 1921 (all Bradstreet figures are for Sept. 1) has been plotted separately, each horizontal two spaces representing three months. This was done so as to indicate the upturn which came in the months of July and August. By comparison this favors the automobile industry even more than would have been the case if the year from Sept., 1920, to Sept., 1921, had been plotted as a straight line. At the bottom point, June 1, 1921, it reached 10.6169 as compared with the Sept. 1, 1914, figure used for a standard, 9.7572, or within 8.8 percent of this pre-war standard.

Going forward a year and a half, at the end of 1920, the list had decreased so that it averaged but 147.2 and the materials used in car manufacture 144.5. Against this, the automobile average had continued to rise and had reached and passed the pre-war standard, that is it had gone to 101. Here again, the comparison was favorable, for while the other products were approximately half again as high as before the war, automobiles were just 1 percent higher.

Coming closer to date, August 1, 1921, saw many more declines, the largest and most notable being among the metals. Much as this was reflected in the down turn in automobile prices, but is still being reflected now a month or more after that date, and appears about to continue, perhaps right through the fall, and up into the new year. This is logical and reasonable for more metal enters into automobile construction than any other material, and the recent heavy cuts in prices of pig iron and steel have had important bearing upon motor construction, but a bearing which will be brought out more strongly as time passes.

On this date, the general average had declined to 115.1, despite the increases in corn, hogs and coal, and the ten products used in motor construction were down to 105.5. Against this, the average car had decreased in price by more than $300, so that the figure was down to 91. That is while materials in general were getting back to about 15 percent above the pre-war level, automobiles had gotten down to almost 10 percent below it. Here, as in all the previous years, the disparity favored the motor car, and carries out the thought previously expressed that the automotive manufacturers have always been the last to increase, and when forced to do so, have increased by a smaller amount than other products or commodities, and that they have been the first to decrease, and have decreased by greater amounts than any other materials, products or commodities.

This chart of prices is well worth study by anyone interested in the general course of prices, or in motor cars in general.

Carrying the argument forward, if all commodities reduce in the same ratio for 1921-1922 as in 1920-1921, except rubber recently below cost and now moving upwards, they would average 94. Similarly, if raw materials reduce in the same ratio, except bituminous coal unchanged and coke, pig iron, steel billets and bars at half 1920-1921 ratio, the average would be 98. The two groups would then average for the fourteen products 96.

If automobiles should continue to reduce at recent rates, and the developments of mid-August and September 1st would seem to indicate that they may even be accelerated, the 1922 figure would be 82.6. So that the motor car bids fair to hold its lower level, lower even (as stated previously) than the materials from which it is assembled.

To point out the low car and truck levels, the additional chart, Fig. 2, has been prepared. This shows graphically the average car prices (according to Automotive Industries) for recent years, the average truck prices, the average value of car exports and the average value of motor truck exports.

In this the very low prices of cars, which did not cross the base line, or average of 1913 and 1914 prices used as 100 percent, until late in 1920, in fact taking the whole year's difference as spread evenly over the twelve months, it did not cross the base, or exceed the 100 percent standard until October. Estimating the recent cuts as closely as possible, it appears to have reacted down below 89 as of August 1st. In this connection it is interesting to note that prices have not apparently followed the usual business rule of competition, for with a less number of manufacturers they have constantly decreased, and in several years when the number of manufacturers increased, which might be considered as greater competition, the prices increased. The output, on the other hand, has steadily increased each year up to 1918, when it was interrupted by war work, and in 1919, did not get back to quite its previous stride.

This is shown in Table II, in which the years, numbers of makers, prices, price percentages based on 1913 and 1914 averages, and the year's production are given. All these prices it should be noted are as of January 1st, whereas the production is for the full year. It will be noted that these average car prices do not agree with those used in the larger chart, Fig. 1. This is because the latter is an average of all cars and all models, while the figures in Table II represent the average of the touring cars only. In this respect, the latter is a fairer representative of the industry, inasmuch as the more expensive car builders go into enclosed and partly enclosed models more than do the cheaper car makers. Consequently, the figures for all models of all makes would include a larger number proportionately of the most expensive vehicles, and as a result, would be (and is) much higher. Thus, the averages for 1913 and 1914, taken as the 100 percent standard in each case, are $3,465.39 for all models, and $2,610 for the touring models only.

In the export figures an unusual situation is shown, in that the department of commerce changed from a fiscal year to a calendar year basis in 1918, consequently two sets of figures are available for 1918 and 1919, that is figures for both the fiscal and calendar years. In 1919, this average difference is almost $100 per car, the calendar year being lower, and with the trucks for the same year, the difference is more than $400 per truck, the calendar year again being the lower.

The truck figures given in Table III speak for them-

Table I—Recent Relative Prices for Motor Cars, Commodities and Raw Materials

Commodity Prices

	Aver. Jy. 1913 to June 1914 as std.		July 1 1915	July 1 1916	July 1 1917	July 1 1918	Dec. 31 1920	Aug. 1, 1921 price	Aug. 1, 1921 & %
Corn, bu.	$0.6840	100	114	118	299	243	101	122	$0.8325
Flour, bbl.	4.5699	100	154	133	279	234	236	189	8.63
Hogs, 100 lbs.	8.30	100	88	116	183	212	115	125	10.35
Wheat, bu.	1.00	100	146	128	273	239	164	121	1.215
Cotton, lb.	0.1375	100	69	100	196	232	107	92	0.12
Hides, lb.	0.17	100	121	150	193	178	103	80	0.135
Rubber, lb.	0.6938	100	77	85	94	85	62	25	0.17

Raw Material Prices

Copper, ingot, lb.	$0.1501	100	132	177	212	170	85	78	$0.1175
Lead, lb.	0.04	100	137	162	268	191	119	103	0.0425
Coal, bitum., ton	2.185	100	101	101	229	188	114	137	3.00
Coke, short ton	2.0625	100	85	127	594	291	243	145	3.00
Pig iron, Bess., long ton	15.6858	100	95	140	366	233	223	144	22.46
Steel billets, bas. 1 ton	21.8333	100	98	195	435	218	199	137	30.00
Steel bars, cwt.	21.26	100	101	198	357	230	190	120	1.75

10 Commodities and Raw Materials

Cotton, hides, rubber, copper, lead, coal, pig iron, steel billets and bars averaged	100	101.6	143.5	294.4	201.6	144.5	105.5

Automobile Prices

	Mean of averages Jan. 1913-Jan. 1914	Jan. 1, 1916	Jan. 1, 1918	Jan. 1, 1921	Aug. 1, 1921
Automobiles aver., all makes and models, pass.	$3,465.39	$2,560.96	$3,111.61	$3,491.28	$3,177.06
Percentage on comp. basis	100	74	90	101	91

Bradstreet's Index Number

	Sept. 1 1914	Sept. 1 1915	Sept. 1 1916	Sept. 1 1917	Sept. 1 1918	Sept. 1 1919	Sept. 1 1920†	Sept. 1 1921
Aver.- 13 groups*	$9.7572	9.8034	11.7803	16.6441	19.0260	19.4720	17.9746	1.0868

* Groups are as follows: Breadstuffs, live stock, provisions, fruits, hides and leather, textiles, metals, coal and coke, oils, naval stores, building materials, chemicals and drugs, and miscellaneous.

† Highest point, Feb. 1, 1920, $20.8690.

selves, but it is interesting to note that the 3-ton figures are uniformly the highest, in each year, and reach the highest percentage above the 1913-1914 standard. The industry is gradually taking up the intervening sizes, namely 1½, 2½ and 3½ tons, but unfortunately figures for these sizes are not available for the earlier years, especially for the years 1913 and 1914 used as a standard, upon the motor vehicle. Neither does it include the more than 4,000,000 chauffeurs, nor the employes of exporting firms dealing largely or wholly in motor vehicles or parts.

The chart shows an industrial activity of 87 percent of 1920, as compared with 82 percent for cotton, 75 percent for labor in general, 41 percent for zinc, and 39 percent for pig iron. The automotive figure is that given by the Natonal Automobile Chamber of Commerce, cotton is taken from the U. S. bureau of census, zinc from the Amer. Zinc Institute and iron from Iron Age. In connection with the latter, subsequent events show an even lower level. In an August issue of Iron Trade Review, the figure of operations for blast furnaces making pig iron was shown to be but 69 furnaces in blast out of a total of 435, or 15.8 percent. Nor were all these operating at capacity, so the August figure would be about 12-13 percent of capacity. As August of 1920 was a month in which the furnaces were working at approximately 90 percent of capacity, this means that August, 1921, showed operations of 13½-15 percent of 1920 instead of the 39 charted for the second quarter.

Summed up, this chart means that in the matter of offering employment, and thus keeping the wheels of industry turning, Mr. Clark previously quoted, was right when he said, "The motor industry is supporting more persons during the period of general business depression than any other—and is one of the largest contributors to our national welfare." And this, too, has been done as previously stated, with a slower and lower war increase

Table II—Comparative Motor Car Prices and Production

Year	Price	P.C.	Export	P.C.	Year's Production
1913 (156 makes)..	$2,585		$999		461,500
1914 (133 makes)..	2,635	100.0	897	100.0	543,679
1915 (119 makes)..	2,005	78.6	885	93.6	818,618
1916 (108 makes)..	1,600	61.3	723	76.5	1,493,617
1917 (131 makes)..	1,687	64.8	751	79.1	1,740,792
1918 (125 makes)..	1,822	70.0	866	91.3	926,388
			982*	103.8	
1919 (85 makes)..	2,226	85.5	1,182	125.2	1,657,652
			1,098*	116.0	
1920 (92 makes)..	2,537	97.0			1,883,158
			1,161*	122.4	
1921 (117 makes)..	2,648	101.4			†1,400,000

* Exports previous to 1918 are for fiscal years, in 1918 and subsequently, for calendar years.

† Estimated from N.A.C.C. reports of factory activity.

Price is average of touring models of each make only and is made as of Jan. 1.

Table III—Motor Truck Prices and Relative Values

Year	1-Ton Price	%	2-Ton Price	%	3-Ton Price	%	4-Ton Price	%	5-Ton Price	%	Composite	Exports Price	%	Production
1913	$1,785	100.0	$2,619		$3,094		$3,762		$4,390			$1,749		23,500
1914	1,667	100.0	2,571	100.0	3,238	100.0	3,857	100.0	4,381	100.0	100.0	1,507	100.0	*25,375
1915	1,666	96.5	2,405	93.1	3,262	102.7	3,335	87.4	4,333	99.0	95.74	2,796	171.8	74,000
1916	1,664	96.4	2,238	87.2	3,143	99.0	3,548	93.0	4,286	98.0	94.52	2,671	164.2	90,000
1917	1,524	88.5	2,310	89.8	3,334	104.8	3,545	93.0	4,190	95.6	94.34	2,655	163.0	†128,158
1918	1,618	93.7	2,500	96.4	3,334	104.8	3,857	101.8	4,500	103.0	99.94	2,612	162.0	†227,250
												‡2,601	160.0	
1919	1,815	102.7	2,758	103.1	3,666	116.1	4,143	108.3	4,647	106.0	107.24	2,669	164.0	316,364
												‡2,273	140.0	
														322,039
1920	1,799	102.0	2,809	104.2	4,166	132.0	4,428	116.0	4,950	113.0	113.44	‡1,609	99.0	
														§200,000

* From U. S. census report.

† Automotive products section, war industries board figures.

‡ Exports previous to 1918 for fiscal years, subsequently, for calendar years.

§ Estimated from known production figures for first six months.

consequently they had to be left out although representing more than 19 percent of the total production in 1920.

The item of greatest interest to the country at large is that of industrial activity of automotive plants, as compared with other industries. For the second quarter of 1921 this is shown graphically in the chart, Fig. 3. In 1920, vehicle manufacturing together with parts and accessory business, were estimated to have 703,560 persons engaged in manufacturing, vehicle manufacturers alone having 325,000 employees. This is exclusive of 33,893 dealers, 35,887 garages, 45,135 repair shops, 4,204 charging stations, or the many employes of oil, rubber, good roads building, or other activities which are dependent in prices, and a quicker and larger post-war decrease in prices than any other industry.

More than one thousand men were added to the working force of the various plants of the Cadillac Motor Car Company in Detroit early in August, making a total of more than four thousand men now employed.

If anyone had dared to predict in 1912 or at any time in the preceding seventy-five years that a day would come when that development would cease and a positive shrinkage in the totals would appear, he would have been laughed out of court. Yet, once more it is the unexpected that has happened.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO

Heptagon Building, 153 Waverly Place, New York City

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXIII September, 1921 No. 6

Business Conditions Improving Slowly

CONSIDERING each with its proper value, there are a large number of straws showing which way the business wind is bowing, and taking them collectively without stressing any one, it would appear that business is taking a marked turn for the better. So much is this the case that one would be justified in saying that the turn had been reached and passed.

Consider for a moment some of the items (or straws) upon which the above statements are based: The New York Federal Reserve Bank, the largest and most important in the reserve system, has just reported the largest gold reserve in its history, crossing a billion dollars for the first time. As a result of this (its extremely strong reserve position) it has again reduced its rediscount rate, this time from 5½ to 5 percent. This means not alone cheaper money, but the large gold stock insures plenty of money for rediscounts. In short this means plenty of cheap money, for the first time in nearly two years.

The Boston reserve bank holds less gold but has an even higher percentage of reserve (more than 84). This latter is because New England's wool, textile and leather industries are all operating at capacity, and doing splendid business. Wool markets are improving, and manufacturers of wool products are reported operating at 114 percent of normal capacity. Textile mills are now operating on full time, and quite a few are starting overtime operations. The secretary of the New England Shoe & Leather Exchange reports the shoe factories following textile mills back to full-time operations and capacity production. Lawrence, Mass., is credited with the largest increase in employment of any city in the country in July.

Postal receipts in August showed the first increase in months, and this was a substantial one. Commercial failures also show a substantial decrease in the liabilities involved. Idle freight cars decreased more than 23,000 during the last week in August, while railroad earnings are steadily increasing, July showing a net income $17,000,000 better than June.

Wheat will show an average crop, but wheat exports in August were four times the previous maximum record. A bumper corn crop is predicted but even in the face of this corn prices are holding up, so the farmers may be said to have passed through their period of depression Cotton has gone up to 21 cents on the government report of the poorest condition and smallest output in years, and is fairly stable now around 20 cents. This means much prosperity for the south.

Both crude oil production and gasoline consumption created new records for the first six months of the year, subsequently slowing down. At the end of July gasoline stocks were down 66,000,000 gals from the previous month's high record. Producers of oil and refiners producing gasoline are taking a more cheerful attitude and oil prices are stiffer, with gasoline lower. There is less talk of a shortage of car and truck fuels in the near future.

Pig iron for August showed a gain, with prices stabilized, while some steel prices are still declining. Steel experts, however, say that steel prices are only 37 percent above the pre-war level, this is relatively lower than any other of ten basic commodities, excepting only farm products and nonferrous metals. Although the U. S. Steel Corp.'s unfilled tonnage report showed a decrease during August to the lowest level in four years, with the single exception of May, 1919, steel production generally is increasing and ingot production in August showed a 42 percent increase over July and 12 percent over June. The reduction in steel prices has brought out a large amount of business and in the last ten days a large amount of steel fabricated work has come on the market. especially in and around New York. A slight reduction in cement is expected to stimulate fall building to a considerable extent.

The chairman of the Amer. Smelting & Refining Co., just back from Europe, remarks on a satisfactory and increasing demand for copper from European sources, while domestic stocks are being reduced at a monthly rate of about 50,000,000 lbs. Copper prices have recently stiffened up, as have also lead and tin, with zinc and aluminum firmer.

Automobiles shipped in July showed a considerable increase over June instead of the customary summer decrease, and partial figures show August to have been an even better month. Ford made several new high records in August including the total output, which was 117,696. or at a yearly rate of 1,400,000. Studebaker, Haynes and others also made new production and shipping records.

While rubber has gone up slightly it is still far below prices in recent years, as are also tire fabric and the other materials used in tire construction. Tire prices are low, and a satisfactory business is being done on a lower number of employes. Shipments of tubes, casings and solid tires all made new high records for the year in July. One of the largest tire plants produced in three weeks of August 12 percent more than in the whole month of July.

Taking all these small indicatons of business cheer together, and considerng that they come from all sections of the country, it seems fair to conclude that business as a whole is definitely better and improving from week to week.

How Many People Can Buy Motor Cars?

Figures Bearing on the Absorbing Topic to Car Manufacturers, the Saturation Point, and the Time in Which This May Be Reached

AUTOMOTIVE statisticians can always be sure of an interested audience when they start to talk about the "saturation point," and to tell what it is and when it will be reached. This perennial topic interests manufacturers because when that point is reached, their business will settle down to the supplying of the demand for motor cars for replacements only. Manufacturers are not worrying about that time because long before it is reached only the most efficient of the big producers will be left so that the business will be divided among a few strong firms in proportion to their ability to produce cars.

It is undeniable that the country is going to continue growing in numbers and individual wealth, while larger scale production is bound to bring about much lower car prices, as will also the more strenuous competition of the next few years. This will result in widening the field materially, as the cheaper the car the more persons there are who can afford to buy it.

Among the recent statisticians to enter into this alluring pursuit of the ultimate number of cars is Col. Leonard P. Ayres, vice-president, Cleveland Trust Co., Cleveland. He has gone into the matter most thoroughly, as his tables and deductions which follow show, and has arrived at the conclusion that the market limit in this country is twenty millions of cars (20,000,000), against which present production is around two and a half millions per year (2,500,000) of which more than a million go to replace cars which are worn out, burned, destroyed or cast aside as of no further use. He works forward from the assumption that there are now 10,000,000 cars in use in this country. Since the registrations for the end of 1920 were approximately 9,200,000, and the rate of addition is slightly more than 150,000 per month, at the end of July, the seven months' net gain would have carried the registration figure past the ten million mark and his assumptions are seen to be correct in this respect.

The known number of cars in New York state, plus the known number added in the first six months, plus a similar ratio of gain for the extra month, would give a figure of about 750,000 cars at the end of July. Taking the ratio of this figure to last year's total for the state, and figuring the same relation exists for the whole country, we get by proportion (from last year's total of 9,211,295) a figure of approximately 10,250,000. Thus, Col. Ayers' assumption of ten million in use at the end of July is proved to be correct from another standpoint.

Col. Ayres starts with the population of the United States, which he sets down as 105,000,000 (recently published government figures show that it would have been more correct to take 108,000,000), and from this figures the greatest number of possible automobile buyers to be less than twenty millions. He goes on to say that the figure of 20,000,000 is about the number of white American families. It is about the number, too, of persons whose occupations and earning power are such that they might buy automobiles. Not every man who has the price of an automobile will buy one. For example, there are fishermen, lumbermen, sailors, soldiers, lighthouse keepers and others who would have scant opportunity to drive a car after they got it. Almost anybody will agree that for a lighthouse keeper to invest his earnings in a high-powered touring car would be a downright extravagance. Then there are thousands of people living in cities whose earnings might permit them to keep automobiles if they were in a smaller place, where garage rents are less, and also where there is less traffic. Highway congestion, so thick as to spoil the pleasure of automobiling, usually occurs where the garage costs are the highest.

42 Cars to Every 100 White Men

Mr. Ayres finds that, at the end of 1920, there were about forty-two cars in use for each 100 white men of voting age. In several states the entire population might crowd into the automobiles there registered and all go riding at once. Each car lasts, on the average, about six seasons. It may be resold once or twice within that time but it runs six seasons before it is finally out of commission. From now on the better grade of cars will doubtless last much longer.

It seems altogether doubtful if the sale of the higher-priced cars will ever be much more than it is now. Since 1916 the increases in the annual output of automobiles have been largely accounted for by the mounting number of sales of Fords and other less expensive makes. Ayres believes that for several years new users of cars will be confined largely to people of limited means who will buy these less costly machines.

Let us take a look now at the Ayres methods of arriving at conclusions. From here on I shall quote from all parts of his report of the results of his inquiry:

Fairly reliable figures for the registration of automobiles in each state are available, beginning with the year 1912. They have been compiled from year to year by Automotive Industries, the office of public roads and rural engineering, in the department of agriculture and other agencies. Where figures have been missing in the original records they have been supplied by using data based on those of neighboring states. Similar methods have been used where the data were based on three-year registrations, or perennial systems. The figures shown in Table 1 are in round thousands, because it was believed that greater detail would not increase their reliability. The data include both passenger and commercial cars, but not motorcycles, tractors or dealers' cars. Table 2 represents an attempt to give the essential data with regard to the production and use of automobiles since the beginning of the industry in this country. Its production figures have been taken from the reports of the census each five years beginning with 1899, supplemented by data for the intervening years compiled by the National Chamber of Commerce. In addition, the war industries board reported official figures for the years 1917 and 1918.

TABLE I—THOUSANDS OF MOTOR CARS REGISTERED IN EACH STATE AND IN THE GEOGRAPHIC DIVISIONS EACH YEAR FROM 1912 TO 1920

	1912	1913	1914	1915	1916	1917	1918	1919	1920
Maine	8	11	16	22	31	41	40	53	63
New Hampshire	6	7	10	13	18	22	25	32	35
Vermont	4	6	8	11	16	20	22	27	32
Massachusetts	50	63	77	103	137	174	193	247	305
Rhode Island	9	10	12	16	21	37	36	45	50
Connecticut	24	27	33	44	62	86	93	110	119
New England	101	124	156	209	285	380	409	514	604
New York	107	134	170	234	318	412	464	572	669
New Jersey	43	49	60	78	104	135	156	191	228
Pennsylvania	59	76	113	160	231	325	394	482	570
Middle Atlantic	209	259	343	472	653	872	1,014	1,245	1,467
Ohio	63	86	123	181	252	347	413	511	615
Indiana	34	47	66	97	139	192	227	277	333
Illinois	68	95	131	181	248	340	390	478	569
Michigan	40	54	76	115	160	247	262	326	413
Wisconsin	25	35	53	80	116	166	197	237	293
East No. Central	230	317	449	654	915	1,292	1,489	1,829	2,223
Minnesota	29	38	68	93	138	163	165	195	224
Iowa	47	75	112	152	199	254	278	364	437
Missouri	24	38	54	76	104	148	188	244	297
North Dakota	9	13	16	25	40	63	72	83	91
South Dakota	14	15	21	29	44	67	91	105	120
Nebraska	16	26	41	59	101	148	175	192	223
Kansas	22	34	49	73	112	159	189	228	265
West No. Central	161	239	361	507	738	1,002	1,158	1,411	1,657
Delaware	2	2	3	5	7	11	13	16	18
Maryland	10	14	20	31	44	61	75	96	112
Dist. of Columbia	2	2	5	8	13	15	30	35	40
Virginia	6	9	14	21	35	55	72	94	134
West Virginia	5	5	6	13	21	31	39	50	79
North Carolina	6	10	15	21	34	56	72	109	141
South Carolina	10	12	15	15	19	40	55	70	93
Georgia	19	19	21	26	48	70	100	127	144
Florida	2	2	3	11	21	27	54	55	74
So. Atlantic	62	75	102	151	242	366	510	652	835
Kentucky	5	7	12	20	32	47	66	91	113
Tennessee	9	12	20	25	30	48	63	80	102
Alabama	3	5	8	12	22	33	46	59	75
Mississippi	3	3	6	10	25	37	48	55	63
East So. Central	20	27	46	67	109	165	223	285	353
Arkansas	2	3	6	8	15	29	41	49	59
Louisiana	7	7	12	11	17	28	40	51	66
Oklahoma	7	8	14	25	53	100	122	145	204
Texas	35	54	65	138	198	213	251	331	428
West So. Central	51	72	97	182	283	370	454	576	757
Montana	2	6	10	14	24	43	51	59	61
Idaho	2	2	3	7	13	25	32	42	51
Wyoming	1	2	2	4	7	13	16	21	24
Colorado	9	13	18	28	43	67	84	105	129
New Mexico	1	2	3	5	8	8	15	18	22
Arizona	2	3	5	7	12	20	24	29	35
Utah	3	4	7	9	14	24	32	35	43
Nevada	1	1	1	2	5	7	8	9	10
Mountain	21	33	49	76	126	207	262	318	375
Washington	14	24	30	39	61	91	117	149	174
Oregon	10	14	16	24	34	49	63	83	104
California	65	103	124	164	232	307	365	477	569
Pacific	89	141	170	227	327	447	545	709	847
United States	944	1,287	1,773	2,545	3,678	5,101	6,064	7,539	9,118

After making allowance for imports and exports, it is found that the total number of new cars put into use in this country since the beginning has been 11,075,813. Since the number registered last year was somewhat in excess of 9,000,000, and the number in use at the end of the year undoubtedly rather less than that number, it follows that about 2,000,000 cars have been eliminated. The next question is how these eliminations have been distributed. Now, registration can only consist of two kinds of cars—new ones made during the year, and old ones carried over from the previous year. Since this is true, the carryover can always be found by subtracting the new cars from the total registration. The cars registered in 1920 were more than 9,000,000. Since about 2,000,000 were new cars made in that year, the carryover from 1919 was about 7,000,000. But the registration in 1919 was about 7,500,000; so that the elimination in that year was in the neighborhood of 500,000. The actual figure given is 446,010.

Some cars, of course, are destroyed almost as soon as they are put into service, while others, that were first registered ten years or more ago, are still running; but the outstanding fact about the registration figures is that they have been for the past nine years about equal each year to the sum of the cars produced in that year and the five previous years. This means that the average length of life of the cars has been about six registrations. The fact that some indivdual cars have much longer or shorter terms of use does not alter the inference about the average term of use.

There is available additional evidence tending to substantiate the proposition that the average length of service of automobiles is about six registrations, which is equal to something more than five full years. For example, the report of the postmaster general for 1916 indicates that the depreciation of cars in the postal service has been at the average rate of 22.9 percent per year. The annual reports of the statistics of express companies, published by the interstate commerce commission, show substantially the same depreciation. These cars receive exceptionally hard usage.

How Many Cars Can be Used?

Such figures as these bring to mind the question of the limits of the ability of the country to purchase and use cars. Estimates regarding this limit of using capacity of the country have varied enormously. On the other hand, as already suggested, states, such as South Dakota, Iowa, Nebraska, Kansas and California are so well supplied with automobiles that the entire population could probably go riding simultaneously. On the other hand, it may be argued that with only about 9,000,000 motor vehicles in use, in a country of more than 105,000,000 people, great possible markets still exist.

This last suggestion is worthy of more detailed consideration, and perhaps the most enlightening way to approach it is through studying the composition of the population with reference to its probable purchasing power for automobiles. Unfortunately the census data for 1920 are not yet available, but those of 1910 give us a fairly reliable basis for discovering the proportions of the whole population found in certain great groups.

The number of persons in the entire population for each car in use in 1912, 1916 and 1920 is shown in the following table:

Table 3—People Per Car in Use

Division	1912	1916	1920
New England	76	28	13
Middle Atlantic	109	36	16
East No. Central	94	25	10
West No. Central	84	18	9
South Atlantic	232	61	18
East So. Central	473	89	27
West So. Central	202	38	14
Mountain	154	27	10
Pacific	57	17	7
United States	114	30	12

These figures impressively illustrate the great rapidity with which the automobile has been adopted by the American people. So short a time ago as in 1912 there were 114 people for each car in use, while eight years later there was one car for each twelve people. The table shows also the great differences that exist between the several divisions of the country with respect to the use of motor cars. The extremes are found in the states of the Pacific division, with one car for every seven persons, and those of the east south central division, with one car for each twenty-seven persons.

Here are figures showing the percentage of the population found at the previous census period in each of three age groups and five nativity groups:

Table 4—People by Age Groups

Group	Under 21	From 21 to 65	Over 65	Total
Native born white males	18	18	1	37
Native born white females	18	17	1	36
Foreign born white males	1	7	1	9
Foreign born white females	1	5	1	7
Colored	6	5	..	11
Total	44	52	4	100

The table shows that great deductions must be made from the total population of the country as soon as we begin the attempt to estimate the possible purchasers of automobiles. To begin with, some 44 out of each 100 are less than 21 years of age, while 4 in each 100 are over 65 years of age. This leaves 52 percent of the people from whom most of the purchasers must clearly come. Seventeen of these 52 are immigrants and colored people. While there are in the aggregate many motor owners in these groups, it seems entirely probable that no very large number among them who do not already own cars will be able to purchase them during the next few years.

The remaining possible purchasers are the remaining 35 percent, consisting of the native born white men and women between the ages of 21 and 65. About half of them are women who are, in the main, the wives of the men. It seems to be a fair conclusion that the purchasers of automobiles will in their very great majority come from the 18 percent of the population who are native white men between the ages of 21 and 65. Since the population consists of some 105,000,000 people, this group comprises about 19,000,000. Probably about half of them already own cars. This seems to be a safe conclusion even after the allowance has been made for the ownership of more than one car by one individual and the ownership of trucks and passenger cars by corporations.

Those Who Can Afford Automobiles

Computations have been made to discover the number

of cars in use each year in each division of the country for every 100 native white men above the age of 21, for it is believed that this is a safer basis for estimating possible future domestic markets than most of the others that have been used. These computations are based on the data that have already been reviewed except that all native white men over 21 have been included, instead of only those between the ages of 21 and 65. The group used includes all native white men of voting age, and the approximate number of them in each geographical division has been computed. The results are presented in the following table:

Table 5—Cars in Use for Each 100 Native White Men of Voting Age

Division	1912	1916	1920
New England	7	20	42
North Atlantic	5	15	34
East North Central	5	19	45
West North Central	5	25	57
South Atlantic	3	10	35
East South Central	1	7	22
West South Central	3	15	39
Mountain	3	16	45
Pacific	7	24	60
United States	5	17	42

The important fact revealed by these figures is that the number of potential purchasers in this country who are still unsupplied with cars is much smaller than has generally been supposed. Another significant fact is that the use for this criterion for computing the probable limits of the domestic market gives results that vary much less between the different sections of the country than do the figures based merely on the relationship between the number of people and the cars in use. Nearly every family would doubtless like to own a passenger automobile. But the facts seem to show that no such universal use of automobiles is possible at present or in the near future because a large proportion of the people cannot afford to purchase or to run them. The only competent estimates of the distribution of incomes in the United States are those for 1910 compiled by Willard I. King, in his volume entitled 'The Wealth and Income of the People of the United States." Those figures are now seriously out of date and do not represent present conditions. Within a few months a sew series of carefully compiled estimates will be published by the national bureau of economic research in New York City. The new figures, like the old ones, will show that many more than half of all the income receivers get less than $1,000 a year.

It is sometimes suggested that the number of cars in use may actually decrease now that the abnormal wages of the war period are past. Mr. Ayers believes it improbable that anything short of a prolonged era of serious business depression can force many people who now have cars to give them up. He asked many people in different walks of life under what conditions they would sell their machines and do without them. The replies were uniformly to the effect that only prolonged adversity of a severe sort would force such a sacrifice. It seems plain that after people have become accustomed to using automobiles they will not give them up unless virtually forced to do so.

The productive capacity of the automobile industry in this country has been stated to be 2,660,000 cars a year at the close of 1920. This figure is probably fairly accurate, for the cars produced in 1920 were about 2,200,000, with curtailed operations prevailing in the last three or four months. As new plants have since been completed.

TABLE 2—PRODUCTION AND USE OF AUTOMOBILES IN THE UNITED STATES SINCE THE BEGINNING OF THE INDUSTRY

Year	Cars carried over from last year	Ford cars made	Other cars made	Cars imported	Cars exported	Total new cars added during yr.	Cars registered during year	Cars eliminated during year	Cars in use at end of year
1895	....	....	300	....	....	300	300	....	300
1896	300	....	600	....	....	600	900	....	900
1897	900	....	1,200	....	....	1,200	2,100	....	2,100
1898	2,100	....	2,400	100	....	2,500	4,600	....	4,600
1899	4,600	....	3,874	150	....	4,024	8,624	....	8,624
1900	8,624	....	5,000	200	....	5,200	13,824	300	13,524
1901	13,524	....	7,000	250	184	7,066	20,590	600	19,990
1902	19,000	....	9,000	300	535	8,765	28,755	1,200	27,555
1903	27,555	708	10,292	350	822	10,528	38,083	2,500	35,583
1904	35,583	1,000	21,830	400	949	22,281	57,864	4,024	53,840
1905	53,840	1,695	23,305	496	1,348	24,148	77,988	5,200	72,788
1906	72,788	1,599	32,401	1,295	1,155	34,140	106,928	7,066	99,862
1907	99,862	8,423	35,577	1,093	2,894	42,199	142,061	8,765	133,296
1908	133,296	6,398	58,602	1,347	2,164	64,183	197,479	10,528	186,951
1909	186,951	10,607	116,680	1,645	4,686	124,246	311,197	22,281	288,916
1910	288,916	18,664	168,336	1,024	8,443	179,581	468,497	24,148	444,349
1911	444,349	34,528	175,472	972	15,807	195,165	639,514	50,662	588,852
1912	588,852	78,440	299,560	868	23,720	355,148	944,000	115,603	828,397
1913	828,397	168,220	316,780	492	26,889	458,603	1,287,000	61,570	1,225,430
1914	1,225,430	248,307	324,732	296	25,765	547,570	1,773,000	56,881	1,716,119
1915	1,716,119	308,213	584,405	221	63,958	828,881	2,545,000	371,196	2,173,804
1916	2,173,804	523,929	1,059,688	1,429	80,850	1,504,196	3,678,000	365,790	3,312,210
1917	3,312,210	735,256	1,133,691	78	80,235	1,788,790	5,101,000	81,219	5,019,781
1918	5,019,781	706,584	447,053	73	109,491	1,044,219	6,064,000	319,009	5,744,991
1919	5,744,991	790,954	1,085,402	117	82,464	1,794,009	7,539,000	446,010	7,092,990
1920	7,092,990	1,027,677	1,177,520	100	180,287	2,025,010	9,118,000	....	....

the country's present annual capacity is somewhat greater and may be in the neighborhood of 2,750,000. It almost surely lies somewhere between 2,500,000 and 2,750,000.

If all these plants should produce cars at their full capacity and if the cars should last on the average long enough to be registered during six seasons, the annual registration would soon be from 15,000 000 to 16,500,000.

If improved construction, more intelligent use, and better roads should increase the average term of service of the cars to eight years instead of six, the number in use would have to be about 17,000,000 or 18,000,000 to take care of the production. This would mean that the number of cars in use would have to be twice as great as it is now. The use in the near future of anything like twice the present number of motor vehicles seems almost unlikely. It is probably true at present that not far from half the white American families already have them, and this half includes practically all the wealthy, the comfortably well-to-do, and a large number who can barely afford to purchase and run their cars. The families and the businesses that have not yet become users of motor cars are largely those who so far have been unable to afford them, and it seems quite unreasonable to suppose that the poorer half of American families and firms will purchase motor cars with anything like the ease and rapidity that has marked their acquisition by their wealthier neighbors. Another consideration of no small importance, as already mentioned, is that if the number of automobiles should be doubled in the near future, some other motive power than gasoline would probably have to be developed to propel them.

The answer appears to be, then, that competition between these manufacturing establishments will be sharper than ever, and prices of automobiles will eventually be much lower.

Based on the least optimistic part of Col. Ayers' figures and deductions given above, it appears that this so-called saturation point is about 11 years off. During the intervening period, however, the population will have increased to such an extent (not taken into account by Ayres) that in the same proportion, another year and a half will have been added. It seems reasonable however to add that the whole tendency of automobile construction and prices has been toward larger and larger output per factory, and this has brought about lower and lower prices. Present Ford plant capacity and profits make it not unreasonable to assume the sale of the touring car for $200 or less before the end of this 12½-year period. Similar greatly reduced prices on all other makes will doubtless have cut profits down to such a low point that while the larger companies will produce many more cars than now, the total yearly production will be less.

It would seem that the widening of the selling field through much lowered price, coupled with the reduced total production due to much sharper competition, will have added before the end of the period mentioned not less than 3½ years at the then capacity output, while the longer life to be expected of the greatly improved cars of the near future will deduct about the equivalent of a full year's production.

Consequently, the so-called saturation point may be considered as not less than fifteen (15) years off. And a good many things can happen in 15 years.

The Johnson Correspondence School

Andrew F. Johnson, the most painstaking teacher of automobile body drafting and construction of which we have knowledge, is very successfully conducting his mail classes from his school at Gray, Maine.

It borders almost upon presumption to "pedigree" Prof. Johnson. Before there were automobiles he was admitted authority on carriage drafting, and for years head of the carriage craft's technical school for carriage mechanics. As the makers of automobiles came to realize their deficiencies in the art of body designing Prof. Johnson commanded attention. That position he has steadily maintained, and those who want to know the rudiments as well as the highest excellences of the art will place themselves under the tuition of the most expert teacher if they investigate Mr. Johnson's plan of conveying information that informs.

The Trend of Motor Truck Design for 1921

A prominent eastern truck manufacturer who has built and tested trucks driven by chains as well as internal gear and worm drive axles has decided as a result of these extensive experiments, to use an enclosed drive rear axle which he calls a dual reduction type. This axle employs only two gear reductions, four gears being used in a gear unit that is a compact assembly located at the middle of the axle and driving the wheels through conventional live axle shafts. The rear axle is a full floating construction, the wheel being carried by two taper roller bearings having opposed load lines, these bearings being placed on the outside of a strong one piece drop forged load carrying member that has a wide yoke at the center, encircling the gear unit. The dual reduction gear arrangement is very similar to that type which is so popular in England, France and in Germany for use on subsidy type trucks intended for heavy duty work and adapted for immediate conversion to military service. The primary reduction is obtained by bevel gearing while the secondary reduction is through a pair of spur gears. The pinion being mounted on the primary reduction shaft while the large member with which it meshes is attached to the differential housing assembly. Tests have shown that this dual reduction gear is nearly as efficient as side chain drive and more efficient that the worm gear drive.—Scientific American.

Remy Has a Glass-Front Switch

Remy Electric Co., Anderson, Ind., is putting a new glass-front switch on the market. Round in shape, and fitted with a glass front, the new switch matches the other dash instruments such as speedometer, clock, gauges and the like. The switch is made up in various styles to conform with the larger instruments such as the clock and speedometer. That is, it is either furnished with a black dial and nickel rim, or with a silver dial and black enamel rim, and so on.

It isn't a mark of shrewdness to keep employes waiting for their pay. The plan of keeping pay a week or two in arrears all the while is a poor plan for all parties concerned. Pay wages just as soon as they are due, and pay them in full

Future of Motor Vehicles in Australia

Of the 60,000 motor cars in Australia, about 40 percent are in the cities, the balance being used by pastoralists and others as necessary in their business. Mail routes are operated under contract, some motor cars being used, but the predominating motive power being horses.

The freight carried by Australian railways annually approximates 28,000,000 tons, all of which has to be carted to the stations, and much of which is transferred from railway to warehouse or wharf by road vehicles. In addition to this, a vast amount of produce is carried directly to seaports and emporiums by road. It has been estimated by an authority that 80,000,000 tons of freight a year are transported entirely or partially by road, mostly by horse-drawn vehicles.

Trucks are very little used in the country, where it is no uncommon sight to see 16-horse teams hauling loads of wool to railways, over distances up to 20 and 30 miles. This part of the freight charge on wool and on other products is much heavier than rail charges. In western Australia camel caravans are occasionally employed at an almost incredible cost per ton of freight carried. In Sydney and Melbourne some heavy carting is done by motor truck and light tucks are used to an increasing extent, but in all cities heavy horse-drawn trucks are used extensively.

The pavements of the principal cities are well adapted for motor trucks, but in the country, where the use of motor trucks would seem to offer prospect of greater economy than in the cities, the roads in bad weather are unfit for motors. A movement for good roads is making headway in New South Wales and Victoria, the former state (whose roads are generally not good) having recently appropriated £500,000 for main-road repairs, while Victoria has appropriated £2,000,000 for the purpose.

The principal objection raised by Australians to the general employment of motor trucks for transportation are the high initial cost, the high cost of petrol, and the cheapness of horse maintenance. It should not be difficult to prove the superior economy of motor transportation, but to convince the average Australian shipper (especially the countryman who is accustomed to regard horses as partially self-sustaining) a campaign of educational advertising will be necessary. Another objection is the difficulty and cost of repairs outside of the principal centers.

The same arguments are applied against farm tractors, but education of the farmer in the economies of motor plowing and cultivation has made more progress than in the case of trucks. Three Australian companies are making farm tractors, but not on a large scale, and can not meet the requirements for these machines which will occur when normal rural conditions return. Of tractors, the caterpillar type seems to be the best adapted to Australian conditions, at least in the larger wheat-growing sections.

A recent development which, but for abnormal credit conditions, would already have increased the demand for both commercial and passenger motor vehicles, is the raising of freight rates by the Australian railways. The credit situation, however, while impeding the present importation of motor vehicles, seems to be creating a new argument in their favor, by making it unlikely that Australia can obtain loans to the required amount for building new railways. Motor car routes into railless territories can be constructed and operated at less expense than can railways. It is stated on reliable authority that in New South Wales motor vehicles are now carrying mail and passengers over 11,000 miles of routes. To cover this distance by railways would cost £153,000,000.

That a country as large as Australia, with great distances between its principal centers and between rich producing regions and seaports, and with vast undeveloped areas, can be satisfied with 26,000 miles of railways and 60,800 motor cars, with few trucks and tractors, is incredible. It is not, at this writing, a good market for cars and allied commodities on account of temporary financial depression. With the readjustment of business and commercial conditions which is now in process, Australia should furnish a good market for motor vehicles.

Pneumatic Tires on Motor Trucks Save Highways

Many roads not originally intended to carry heavy traffic were seriously damaged during the period of the war by the impact of heavy motor trucks. The natural result of this was to warn highway engineers of the importance of planning all future roads with reference to the kind of traffic that is likely to use them. The engineers responded immediately by building thicker roads and roads of more durable material; but in the absence of definite knowledge of the probable strength of the impact they have not known exactly how thick or how strong the roads must be made.

Recent tests of the impact of motor trucks made by the bureau of public roads, United States department of agriculture, develop the facts that when a solid-tired truck strikes a 1-inch obstruction, the impact may be as high as seven times the load, an average being about four times.

The tests show, however, that the impact depends largely on the kind and condition of the tire. Pneumatic tires cause the least damage to the road surface, the cushion of air reducing the impact so that it is seldom greater than 1¼ times the static load on the wheels. Although the impact increases with the speed of the truck, and it is therefore highly desirable to limit speed by strict regulation, the use of pneumatic tires would make higher speed permissible.

Modern Motor Car Upholstering

(Concluded from page 16.)

When fixing the head leather, great care must be taken that all marking points are noted in relation to their respective points on the body; pin round with half inch gimp pins, after which finish off with beading.

Some of the other closed car upholstering methods and materials will be described subsequently, if space permits.

Official figures for the first 11 months of 1920 show imports of passenger motor cars into South Africa numbering 9,150, valued at $18,378,765 at the normal rate of exchange; 239 trucks were imported during this period, valued at $601,205.

Further Pressure-Gage Standardization

At the next meeting of the S. A. E. screw thread division a preliminary report for pressure-gage connections will be acted upon. The principal dimensions specified in the report are the diameter and the threads per inch of the air connection at the back of the instrument. The report has been approved by pressure gage as well as passenger car and motor truck manufacturers. The general adoption of the recommendation will make pressure gages interchangeable as there is already a standard for the outside diameter of the instrument case and the location of the holding screws when used.

Non-Ferrous Metals Standardized

The S. A. E. subdivision on wrought non-ferrous metal alloys has submitted for consideration specifications covering brass forging rod, brass spring wire, naval brass or, as it is sometimes called, Tobin bronze tubing and phospher bronze spring wire. If these specifications are adopted by the society the S. A. E. non-ferrous metal specifications, of which there are now 25, will cover a sufficiently wide range to permit automotive vehicle designers to select standard specifications for practically any automotive purpose for which non-ferrous metals are used. The specfications proposed cover, in addition to the compositions in percentage specified, the physical properties, appearance, dimensional tolerances and general information of interest to users.

Desirable Plate-Glass Practice

In many cases body designers have specified plate-glass window widths without regard to the commercal practice of manufacturing plate glass in even 2-in. widths which has resulted in added cost which might easily have been avoided by a slight change in the window design. It is of course cheaper to use a 19¾-in. width in place of a 20¼-in. width, because the first size can be made from a 20-in. width while the second size would require a 22-in. width, no intervening sizes being manufactured in commercial practice.

Realizing this situation a report has been formulated at the request of the passenger car body division of the S. A. E. which recommends that plate glass for automobile bodies shall be specified in even 2-in. widths in accordance with commercial practice if possible. It is also recommended that the thickness of plate glass should be specified in fractions of an inch, the maxmum variations of thickness of any single piece of glass not to be greater than 1-32 in. in order to prevent the glass from being tapered. The report also recommends that the thickness of plate glass for windshields shall be ¼ plus or minus 1-32 in. and the thickness of pate glass for closed body windows shall be 3-16 plus or minus 1-32 in.

Automobile Theft Prevention Work of S.A.E.

It is generally recognized that one of the most effective ways of identifying stolen automobiles and minimizing the danger of their being stolen in the first place would be the general adoption of a method of numbering engines which would make it impossible to change the numbers without leaving indications that a change had been made.

Replies to a letter from the S. A. E. standards department soliciting advice from automobile manufacturers on this problem indicated that the stamping of plain characters on several parts of the engine and other units of the chassis is the most satisfactory way of guarding against having the numbers changed by automobile thieves. It is realized however, that if a simple means of numbering cast-iron or aluminum castings can be discovered which will make it difficult for the numbers to be changed, it would be a real solution to this problem. The suggestion has been made to the S. A. E. that a solution might be found by the casting of a special alloy block in surface of that part of the engine casting which is to be numbered, the composition of the alloy being such that it would be impossible to change the numbers by any simple means. The selection of such a material would depend, of course, upon its physical characteristics. Members of the iron and steel division have been asked to study the possibilities of this solution.

Any suggestions in this connection which might be developed into a satisfactory means of numbering engines should be referred to the society.

Makers May Standardize Clutch Facings

A. C. Bryan, vice-chairman of of the transmission division of the S. A. E. standards committee, has submitted a preliminary recommendation for S. A. E. clutch facing standards based on present practice. This recommendation will be thoroughly discussed and, if possible, finally acted upon at the fall meeting of the transmission division.

It is believed advisable to divide the facing sizes into two divisions—one for single plate and the other for multiple plate clutches. The majorty of single plate clutches seem to be made in three sizes, 8, 10 and 12 in., and in view of the fact that they are quite simiar in design and are housed by flywheels bored 8, 10 and 12 in., respectively, it would appear that a standard inside and outside diameter can be agreed upon without running into much opposition from the clutch makers, as these sizes will fit into their present clutches without any change in the design of the clutch parts.

A great number of multiple disc clutches on the market are so varied in design that it makes the question of standard facing sizes for this type somewhat more difficult than in the single plate clutch. It is believed that the many sizes of facings now used can be reduced to a comparatively few if the matter is studied by the S. A. E. standards committee.

Wing Nuts to be Standardized by S. A. E.

The Society of Automotive Engineers has been requested to formulate a standard for wing nuts in order that designers may refer to a standard list and select sizes which may meet their requirements.

As it is recognized that the formulation of such a standard should be based on the best present practice the S. A. E. is obtaining data on current practice for the different types of wing or thumb nuts and those standards which are in general use by small industrial groups such as bolt and nut manufacturers.

The adoption of a standard series of wing nuts will do much to decrease the cost of certain wing-nut sizes through greater production and will ultimately result in discontinuing many special sizes.

Excessive Cost of Highway Construction

The Cincinnati Enquirer under the caption, "Where Will It Stop?" has the following very appropriate comment relative to the increasing cost of highway construction:

Columbus dispatches tell an exceedingly interesting story as to mounting highway construction costs that fill the taxpayer with a sort of nervous dread. Year by year the "curve" of highway costs is upward, with never a suggestion of attainment of a maximum altitude and never a downward swing. Despite the slight reduction in labor prices and in commodity prices from past year, the upward trend in highway building costs continues. When shall it stop?

A decade and a half ago, when the state first began the construction of state-aid roads, the cost was a little less than $7,000 a mile. It ascended steadily year by year until the beginning of the big work in 1913, when the cost went to nearly $14,000 a mile, or twice as much as it began with. For just one year the contract prices disclosed a reduction, but immediately the economic conditions across the seas as brought about by the great war caused another sharp rising. At the beginning of the American war period the cost was approximately $16,500 a mile, and then the costs began to go up with airplane-like bounds, reaching $31,228 per mile in 1920 and $33,969 in 1921.

When highway building began in Ohio the work was largely done by hand, but now highway building is largely a mechanical proposition from first to last. Wages have increased greatly, it is true, but whether the labor unit cost has increased because of the improved mechanics is another question. If it has, then production in this department has not kept pace with scientific information, and surely no charge of backwardness in industrial improvement will be levelled against Ohio contractors. The figures demand explanation.

The public has asked for better highways and smoother and wider running surfaces, but it is hard to be composed in face of an increase of 400 percent in 15 years. What is the remedy? Ohio taxpayers ultimately will seek a solution and the highway constructors will do well to anticipate the public's certain efforts. Wise heads, if they be truly wise, will provide a solution lest the goaded taxpayers find one that is more effective than smooth and more thorough than refined.

Increased Italian Automobile Export Trade

Italian automobiles have had a large export demand from the early days of the industry. The manufacture of motor vehicles was stimulated by the war and the conclusion of hostilities found Italian makers prepared to supply the foreign market with larger numbers of cars than ever. In the past 10 years, from 1911 to 1920, inclusive, the countries in which the market for Italian cars has shown an especially notable growth are Spain, Switzerland, Belgium, British India, Holland, Egypt, Algeria, Portugal, Norway, Denmark, and Greece. England in the same decade increased its imports from 939 Italian cars in 1911 to 3,068 in 1920, but Italian automobiles have always met with favor in Great Britain, which, except 1917, 1918, and 1919, took more than did any other country. The German, Russian and Rumanian markets for Italian cars had disappeared by 1920, when there were no records of exports.

Italian automobile interests point to the fact that they have built up and maintained good outlets in countries like England, France, and the United States, where imported cars have to compete vigorously with automobiles of domestic make, especially designed to meet the needs of home markets.

The number of automobiles imported into Italy has been as follows: In 1911, 686; 1914, 1,208; 1918, 80; 1919, 287, and 1920, 287.

Venezuela Needs More Cars

With the extension of Venezuela's system of modern roads and her closer diplomatic and commercial relations with this country exports of American automobiles there are likely to show a striking increase in the near future.

P. L. Bell, American trade commissioner, who recently returned from Venezuela, asserts that the latter country, within the next five years, will double the number of automobiles she has in use. Slightly more than 2,000 lightweight American cars are now being used in Venezuela, he says, and the country needs at least 4,000 cars this year.

There are now 1,600 miles of first-class roads completed and in daily use, and an 800-mile road from the capital, Caracas, to the Colombian border is now in course of construction and will be completed before the end of the year. The economic effect of the new roads is to open a vast territory to agricultural and other development.

In Venezuela the automobile has become a part of the nation's transportation system. It is linking up the new agricultural regions and mineral developments with the cities and railroads. Small trucks are rapidly coming into vogue to carry products where there are no freight lines and tractors are finding considerable favor with farmers.

The automobile in Venezuela is essentially a mode of transportation and many cars are to be found in the agricultural regions. There is a continuous demand for cars now that raw materials are moving for export and American manufacturers will be able to find a market in Venezuela.

Their sale is not dependent upon long terms of credit, for that is not an essential in the trade of that country. During the past few months we have been importing from Venezuela in increasing quantities, and accordingly we can look for an increase in orders from that country.

If you never order goods until there is a demand for them you will lose money. If you stock up freely with goods for which there is no demand, you will lose money But there is a happy medium to be attained by the use of judgment.

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are What They Are What They Are Doing

C. C. Hanch, vice-president of the N. A. C. C. and chairman of its taxation committee, will shortly become executive vice-president of the United States Automotive Corp., Connersville, Ind. He will have active charge of the operating policies of the company, which has as subsidiaries the Lexington Motor Co., the Ansted Engineering Co., the Ansted Spring & Axle Co., the Connersville Foundry Corp., the Fayette Painting & Trimming Co., and the Teetor-Hartley Motor Corp. Frank B. Ansted is president of the organization. Mr. Hanch is well known in the automotive ndustry through his long years as treasurer of the Nordyke & Marmon Co. and the Studebaker Corp., but to the general public through the active part which he has taken in the discussion of federal taxation.

Frank Johnson, automotive engineer, has joined the engineering staff of the Cadillac Motor Car Co., at Detroit. Mr. Johnson began his automotive career in Detroit in 1900. From 1901 until 1906 he was a chief draftsman and designer of the Cadillac and from 1906 until 1917 he was a designer on all engine and chassis parts of the Cadillac cars, doing notable work on the eight-cylinder designs. From 1917 to 1920 he served as chef engineer for another manufacturer of an eight-cylinder automobile in Detroit and personally supervised the design of the entire car with the exception of the body. For the last several months he has been associated with George H. Layng, vice-president of the Cadillac Motor Car Company, in the manufacturing department.

J. H. Duffee, who has been associated with the automotive industry since its inception, is to become the assistant general manager of the Cole Motor Car Co., at Indianapolis. He will assume his new duties October 1. Mr. Duffee began his career with the Locomobile Co. in New York and since that time with the exception of the past three years has been identified very closely with the industry. During recent years he has been connected with the Willys-Overland Co. in several executive capacities. For the past three years he has been associated with Carl G. Fisher, owner of the Indianapolis Motor Speedway, in the development of the Miami Beach, Florida, properties.

Robert S. Fowler, formerly assistant sales manager of the Northway Motor & Mfg. Co. division of the General Motors Corp., and prior to that for six years with the Anderson Electric Co., Detroit, has been made district representative of the Wheel Trueing Tool Co., Detroit. He will include in his district the territory in southeastern Michigan and Toledo, O. E. F. Robinson, who has been with the company as sales manager, has resigned to resume the practice of law in Ravenna, O.

Col. Elmer H. Havens, of the steel jobbing firm of Hunters & Havens, Bridgeport, Conn., has been elected president of the Locomobile Co. of America, Bridgeport. Frank R. Hickman is associated with Col. Havens as vice-president and treasurer. With this change in the officiary of the company the Locomobile Co. also is wholly divorced from Hares Motors, Inc., which had charge of manufacturing and selling the automobiles made at the Locomobile plant.

Charles B. Tamm, for several years chief purchasing agent LeRoi Co., Milwaukee, manufacturer of automobile and tractor engines, has resigned to become assistant general manager of the Hydro-Hoist Co., a subsidiary of the Heil Co., Milwaukee, manufacturer of steel dump bodies, compartment truck tanks, hydraulic hoists, etc.

J. Paul Winchell has been added to the research department of the Duplex Truck Co. Winchell is a graduate of the University of Michigan and was associated with and trained under Prof. A. H. Blanchard professor in highway transport engineering.

S. E. Allen, engineer Stevens-Duryea Co., Chicopee Falls, Mass., automobile manufacturer, has resigned to accept a position on the Pacific coast. E. E. Nichols, superintendent, has resigned, but has made no plans for the immedate future.

H. A. Coffin, who recently retired as manager of the disteel wheel division of the Detroit Pressed Steel Co. has joined the Cadillac Motor Car Co., as assistant to H. H. Rice, president and general manager of the Cadillac company.

William Knudsen, formerly of the Ford Motor Co., has joined the Ireland & Matthews Mfg. Co., Detroit, machinist and sheet metal goods manufacturer, as general manager.

Joseph J. Wilson, gray iron foundry manager for the Saginaw Products Co. division of the General Motors Corp., Saginaw, Mich., has resigned to enter business in Detroit.

Body Builders

H. F. Holbrook, Inc., West End avenue and Sixty-seventh street, New York, manufacturer of automobile bodies, has negotiations under way for the purchase of a one-story plant in the New York district, totaling about 120,000 sq. ft. of floor area, for the establishment of new works. It is proposed to enlarge the building to provide facilities for an annual production of about 1,500 automobile bodies. H. F. Holbrook is president.

General Woodwork Mfg. Co., 3201 North Broadway, St. Louis, has acquired a local plant, including adjoining property, for the establishment of a branch works to manufacture automobile and truck bodies. It is proposed to install machinery and commence operations at an early date. C. W. Redecker is vice-president and general manager.

Buckeye Body Co., Columbus, O., has taken over the property of the Immel Co., automobile body manufacturer. The new company is composed of former stockholders of the Immel Co., who purchased the plant at a receiver's sale. J. W. Dinsmore is president.

Wallis Coach and Carriage Works have incorporated for $150,000 at Minneapolis, Minn. The company will make automobile and truck bodies and parts as well as coaches. F. P. Wallis is president; F. Ritzenger, vice-president and treasurer, and E. B. Wallis, secretary.

Rex Top & Body Co., 388 Newbury street, Boston, manufacturer of automobile bodies, etc., has been acquired by Paul L. Pryor and James F. Malone. It will be continued in operation with Mr. Pryor as president, and Mr. Malone, treasurer.

Detroit Trailer Co. has a contract for 50 four-wheel 5-ton trailers for Brazil. The Mansfield Steel Corporation, Detroit, has the order for 97 steel combination bodies for the trucks and trailers.

Bowman Carriage Co., Sacramento, Cal., has awarded a contract to A. W. Norris, Sacramento, for a one-story machine and repair shop at Twelfth and D streets, estimated to cost about $25,000.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Oshkosh Tractor Co., Oshkosh, Wis., which has acquired the entire business of the LaCrosse, Wis., Tractor Co., has purchased eight acres on Harrison street, between the main lines of the C. & N. and Soo Line railroads, and expects to award contracts within 10 days for the construction of its new plant. Auler & Jensen, local architects, have completed plans for a main bulding, 150x500 ft., of brick and steel, with sawtooth roof of six bays, each 25 ft. wide, with a wing, 25x100 ft., as a motor testing room. Provision also is made for a separate power plant, 60 ft. sq. and a detached office building, 40x80 ft., two stories. The equipment and materials at LaCrosse are now being prepared for shipment to Oshkosh. In addition to this machinery, the company will be in the market for a considerable list of miscellaneous tools and other equipment. L. W. Melcher, factory manager at LaCrosse, will occupy the same position with the new concern.

W. C. Durant, founder of General Motors, Ltd., in Canada, has purchased the property and buildings of the Leaside Munitions Co., Leaside, Toronto, and will install equipment for the manufacture of Durant automobiles. Plans call for a capacity of 100 finished cars a day and it is proposed to manufacture in the dominion every important part of the car, including electrical equipment and tires. A woodworking plant will be erected for the manufacture of car bodies. The main building on the site, 130x640 ft., will be used as a machine shop, where all motors, axles and transmissions will be made. The building program also calls for the construction of a three-story assembling plant, 130x160 ft. It is expected to have the works in full operation by next March.

General Asbestos & Rubber Co., 58 Warren street, New York, and the Raybestos Co., Bridgeport, Conn., will be merged under the first noted name. The consolidated company will have aggregate assets of $9,615,000. The General Asbestos Co. operates a large plant at North Charleston, S. C., for the manufacture of brake lining and kindred products, and the Raybestos Co., in addition to the Bridgeport works, has plants at Stratford, Conn., and Petersboro, Ont. The different plants will be continued in operation. C. Bissell Jenkins is chairman of the board, and Sumner Simpson, president of the new organization.

Durant Motors of Indiana, Muncie, Ind., recently organized with a capital of $3,000,000, has taken over the local plant of the Sheridan Motor Co. to manufacture a six-cylinder car. Extensions and improvements will be made and new equipment installed. Plans are being perfected to commence production in October. Dennis A. Eurke is president and general manager of the company, which is affiliated with the Durant Motors, Inc., 1819 Broadway, New York.

Moline Plow Co., Moline, Ill., is negotiating for the taking over of the machinery and business of the Moline Engine Co., which operated the Root & Vandervoort plant in East Moline. The machinery in the East Moline plant is being dismantled and will be removed to the tractor plant of the Moline Plow Co. in Rock Island, Ill., where it will be used for the production of tractor and automobile engines.

Victor Krefl Mfg. Co., Two Rivers, Wis., manufacturer of shock absorbers and other automotive accessories, has taken over the building formerly used as a machine shop by the Two Rivers Wooden Ware Co. and is installng some additional equipment. It has been occupying under lease the former plant of the Two Rivers Plating & Mfg. Co., which has recently been acquired by the Perfection Hoist & Engine Co., Milwaukee, as its permanent works.

Interstate Car Co., Massachusetts avenue, Indianapolis, manufacturer of automobiles, has awarded a contract to the Central State Bridge Co., Beecher avenue, for a one-story foundry addition, estimated to cost about $25,000. E. H. Darrach is president.

C. A. Carey, 247 West Sixty-fourth street, New York, manufacturer of automobile wheels, has leased the three-story building, 50x100 ft., at 221-23 West Sixty-fourth street, for a new plant. The present works will be removed to this location. C. A. Carey, Sr. and Jr., head the company.

Dodge Brothers, Detroit, have purchased 35 acres in the town of Sandwich, Ont., where they intend to erect an assembling plant to take care of Canadian and British export trade.

Mercer Motors Co., Trenton, N. J., has disposed of a note issue of $2,000,000 and bonds in the amount of $500,000, the proceeds to be used for general operations and expansion. Following the recent separation from Hares Motors, Inc., the company has perfected arrangements for immediate production. Theodore E. A. Barthel is vice-president and treasurer, and George L. Catlin, assistant treasurer and secretary. J. W. MacMorris is general plant superintendent.

Durant Motor Co. of California, Oakland, Cal., has awarded a contract to the P. J. Walker Co., Monadnock Building, San Francisco, for its new plant at the end of East Fourteenth street, at the city limits. It will consist of a two-story, reinforced-concrete building, with four wings, totaling 800x800 ft., and is estimated to cost about $750,000. Construction will commence in about 30 days.

Severin Motor Co., Oakland, Cal., formerly of Kansas City, Mo., will soon take bids for the first unit of its new plant at East Fourteenth street and Fifty-fourth avenue, one-story, 60x450 ft., and estimated to cost about $100,000. It will be followed by other units in the near future, bringing the cost up to about $400,000.

Richelieu Motor Co., Asbury Park, N. J., manufacturer of automobiles and parts, has acquired property on Asbury avenue as a site for a new plant. Initial buildings will be devoted to the manufacture of motors of the Duesenberg type and for assembling work. Robert G Poole is treasurer.

Rickenbacker Motor Co., 1551 Harper avenue, Detroit, recently organized to manufacture automobiles, has preliminary plans under way for a one and two-story plant for initial production. H. L. Cunningham is in charge.

S. H. Vehicle Co., 3291 East Sixty-fifth street, Cleveland, has had plans prepared for a one-story factory, 40x90 ft., to manufacture parts for wagons.

International Harvester Co., Chatham, Ont., has secured a local building for the manufacture of motor trucks, etc.

Ford Motor Co., Detroit, has acquired about two acres of land at Huntington, W. Va., as a site for a new assembling plant. Preliminary plans are under way. E. Vernon Carter is local manager.

Willys-Overland Co., Toledo, Ohio, is arranging for a bond issue of $20,000,000, the proceeds to be used for general operations and financing, plant extensions and improvements for increased automobile production.

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. XLIII, No. 7 NEW YORK, OCTOBER, 1921 $2.00 Per Year Issued Monthly

Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City.
Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3,

The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

Vol. LXIII NEW YORK, OCTOBER, 1921 No. 7

Motor Car Fuel Prospects in the Oil Shales

What Oil Shales Are and Where Found—Amount of Oil Contents and Possible Recovery by Suitability to Every-day Motor Vehicle Use

FOR a number of years, engineers and research men in the automotive industry, petroleum technologists and others vitally interested in fuels have been talking about the oil shales of the far Western states and their possible influence upon future motor car fuels. Now that the day has arrived when automotive vehicle manufacturers begin to wonder just where all of the fuel for tomorrow's cars, trucks, tractors and other units is to come from, it will be well to look into the matter of the oil shales and find out what they are, what the resulting oil product is, and how it is applicable to automotive vehicles.

With oil production reaching its peak this year, and Mexican production declining, it is obvious that the amount of motor fuel, formerly called gasoline, but now admittedly a mixture which certainly is not gasoline, can only be increased by putting all crude oil through the refinery, conducting the refining processes so efficiently as to minimize losses, by adding a greater proportion of the heavier fractions, and by the discovery of new sources of fuel. Obviously, there is also the possibility of other kinds of fuel being mixed in, as for instance, alcohol, benzol, and others. These however, would change the entire character of the fuel, consequently reference is had now to mineral oil products only.

The possible additions through refining all crude oils would add but little to the total supply, for in the main those oils which do not go to the refinery today are the heavier asphalt-base oils which contain little or no gasoline, kerosene and naphtha, that is have no lighter constituents suitable for motor fuel. So this would add little or nothing.

More efficient refining processes, to minimize losses, and especially the applications of cracking processes to heavier fractions, would add considerable, perhaps 10 per cent to the totals of recent years, but in the face of the high rate of vehicle increase (28 percent in 1919, 21 in 1920, and not far from 20 in 1921, by all indications), and the inadequacy of present production (and that of the recent past), this is not enough.

Therefore, we must look to the third item, or discovery of new sources of fuel, as the real salvation. In this class are the shale oils. To sum the situation up quickly, there are estimated to be twenty-two billion tons of oil shale in Colorado and Utah, and 60 gallons per ton is a conservative estimate, so this source may be considered as having possibilities running into thousands of billions of gallons. Thus, the oil shales constitute a tremendous potential reserve. While oil has not been produced from these shales on a commercial basis, and at a profit, in this country, it has been done in Scotland on a basis which gave a slight profit on the oil alone, most of the profit coming from the ammonium sulphate, recovered as a by-product.

Quality of Shale Oil and Shale Constituents

The first question to arise is the constituents of the shales and the quality of the resulting oil. If the shales do not contain an oil which can be used by motor vehicles, and if the destructive distillation of these shales does not produce such an oil, the shales are not worth consideration. In answer to the question as to the constituents of the shales, oil shale may be refined as an argillaceous or shaley deposit from which petroleum may be obtained by distillation only, not by the use of solvents.

The chemical composition of the constituents from which the oil is produced has been the subject of investigation but at present is not wholly understood, and government and private investigations are still proceeding. The term "Kerogen" has been given to the material in Scotch shale and is assumed to be neither petroleum nor bitumen, but a material which yields on distillation, petroleum and ammonium compounds. This substance has also been given the name of pyro bitumen. The origin

of this material in the shale has been variously stated. One theory is that it is formed by the evaporation or drying up, under the action of heat, of oil bearing formations, resulting in petroleum residues which have become insoluble by polymerization.

Another theory, the resin theory, is based on the microscopic examination of the organic matter in the shale. This matter is made up of carbonaceous bits of plants with occasional small spores, yellow bodies believed to be algae, spores, or oil globules, shells of minute crustaceous bones, teeth, and scales of fish, and sand grains. The yellow bodies are considered vegetable matter, and are thought to be fragments of resins formed from the decomposition and oxidation of materials of which they were once a part. These resins undergo changes which age, becoming more insoluble.

Still another theory is that by the action of microbes and under certain special conditions, the different kinds of organic matter, animal or vegetable, are transformed into "Kerogen" or pyro bitumen. Engler's theory of the formation of petroleum and bitumen also embraces the formation of the "pyro bitumens" in shale. By the decomposition of fats, waxes, and other animal and plant remains there are formed free fatty acids, esters, and hydrocarbons. Some of these materials may condense and polymerize to form pyrobitumens, or as Engler's terms them "polybitumens" which are insoluble and infusible. Under the influence of heat, these insoluble bitumens may be transformed into soluble bitumens and under the further action of heat and the additional influence of pressure, the latter go to the natural crude oil, which, or polymerization, yields the heavy asphalts.

Seven Times the World's Output to Date Available

Oil shales occur in various parts of the world in enormous quantities. Colorado alone has sufficient shale to yield fifty-eight (58) billion barrels of oil. There is enough oil that can be obtained from the shale deposits of Colorado, Utah, Wyoming, to supply this country for several generations. Some idea of quantity of oil available in these shale deposits can be formed when it is considered about eight billion barrels of crude oil have been produced in this country since 1859, and Colorado alone can supply fifty-eight (58) billion barrels from its shales. Kentucky and Nevada have extensive deposits of shale. It has been stated by competent observers that in the near future, perhaps in ten years, Colorado and Utah will possess an industry for the mining and distilling of oil shales which will rival in size the great mining and manufacturing industries of this country.

Because of these facts, the successful development of shale distillation is a matter of vital interest to the welfare and prosperity of the United States. Every real effort to accomplish this end should be met with encouragement and sympathy, in particular by those who control the destinies of the oil refineries now in existence. Shale oil can be as readily pumped through pipe lines as crude oil, and when the supply of crude oil is exhausted, in fact long before this point is reached, these same refineries will probably be called upon to use their equipment to refine crude shale oil.

When the shale rock is retorted, a crude oil is obtained, along with gas and ammonium compounds. These hydrocarbons yield, when fractionated, low boiling, intermediate and high boiling fractions. The first product of decomposition, when the shales are distilled, is found to be a heavy semi-solid or solid bitumen, soluble in benzine and carbon bisulfide. The crude oil obtained in the distillation of the shales is produced by the cracking of this heavy bitumen.

How the Oil Is Obtained

There are a number of theories as to the best method of getting the maximum yield of oil and by-products from the shales. Some experimenters hold that excessive heating is necessary, and point out Engler's experiments in which as much as 36 to 55 percent additional oil was produced through prolonged heating up to eight days, and at temperatures from 300 deg. C. to 400. In still other exepriments with Colorado shale it was found that heating above 705 deg. F. increased the amount of oil yield, while between 752 and 770 deg. F. the increase in light oil and heavy oil (bitumen) was considerable.

These latter experiments also show that the higher temperatures bring about cracking of the heavy oils, and their decomposition into light oils, but not sufficient cracking to produce gasoline or anything equivalent to it. The resulting light and heavy oils must be refined or cracked in the same manner as crude petroleum. When this is done, the resulting gasoline is similar to that from crude oil.

Other theories in connection with the distillation of the shales include the use of live steam. Some petroleum technologists claim that they cannot be properly reduced and all oils and by-products recovered unless steam is used. They also claim the use of steam improves the quality of the resulting oils. The government experiments to date show that this is not altogether true, in that the best oil thus far made from American shales has been made without steam. This is important because the use of steam adds to the initial cost of the distilling plant, and also to the operating cost, so that it necessitates a larger investment and makes the product cost more.

In a recent bulletin* the Bureau of Mines shale oil experts have commented on the quality of the oil obtained under the most suitable conditions for producing the highest yields, which is what commercial operations would parallel.

In this it is pointed out first that the quantity and quality can be varied by varying the conditions of retorting, and the following table indicates this:

Time of retoring	2 hrs.	5 hrs.
Oil recovered, gals. per ton	42.75	40.20
Specific gravity of oil	0.889 (27.5° B)	0.877 (29.6° B)
Setting point of oil	33.5° C (92.3° E)	33° C (91.4° F)
Unsaturation percent	43.8	40.6

In this, it will be noted that the yield for the 2-hour period was 6.25 percent greater than for the longer period, and 6.88 percent greater than the 1-hour period (data not given). The trend of unsaturation shows that the method which produces the greatest yield does not produce the highest quality. The oils produced in the longer runs are lighter (lower specific gravity), contain a greater percentage of low-boiling constituents and the lighter fractions contain a slightly smaller percentage of unsaturated hydrocarbons than the oils produced in the shorter runs. Except when a very rapid retorting rate is used, however, the difference in the qualities (so far as this can be determined by distillation methods) of the

*Serial No. 2254, Report of Investigations, Bureau of Mines, Dept. of Interior. Nature of Shale Oil Obtained from Oil—Shale Assay Retort Used by Bureau of Mines, by M. J. Gavin and L. C. Karrick. June, 1921.

oils produced at various rates of retorting is not great. If the shale is retorted very rapidly, the yield of oil drops off to a large extent and the quality suffers greatly. For the particular shale reported in these tests a two-hour retorting period is most favorable for highest oil yields.

Since there is yet no basis for comparison of shale oils on the results in commercial use, it is necessary to base comparisons on analytical distillations of the oils. Inasmuch as the quantity of oil obtained from a single run with the assay retort is insufficient for making an accurate distillation analysis, several runs must be made under identical conditions to obtain the required quantity.

The effects of different retorting rates on oils produced from the same shale, mentioned above are brought out in more detail by the accompanying tab'es showing distallation analyses of oils produced from Soldier's Summit oil shale for two and five-hour retorting periods, respectively. The oil produced at rates of much less than 2 hours was so inferior as regards both quality and quantity, that no effort was made to accumulate enough for distillation analysis. For purposes of comparison, tables of distillation analyses on oil from Scotch shale and on a Pennsylvania crude oil are included.

Method of Distillation Analysis

With minor exceptions, the method used by the Bureau of Mines for the distillation analyses of shale oils is similar to that developed in the Pittsburgh experiment station and used in examining petroleum. It is briefly described in a recent report of the Bureau* issued in mimeograph form, and more fully described in a bulletin soon to be issued. The method requires at least 350 c.c. of oil, 50 c.c. for determination of viscosity, percentage of water, specific gravity and setting point, and 300 c.c. for the actual distillation to produce fractions of sufficient volume for examination.

Briefly, the distillation method consists in distilling 300 c.c. of the oil in a standard fractionating apparatus under definite conditions, taking fractions for every 25 deg. C rise in temperature until the vapor temperature reaches 275 deg. C. Then the distillation is stopped and the oil permitted to cool. A vacuum receiver is then attached to the condenser and the distillation continued as before under 40 mm. absolute pressure until the vapor temperature reaches 300 deg. C. The fractions are then separately examined.

The method of examining the shale-oil fractions is similar to that for petroleum fractions, with the following exceptions:

(a) Viscosities are taken at 60 deg. C (140 deg. F) instead of at 100 deg. F because of the high solid paraffin content of many shale-oils and of their higher boiling fractions.

(b) Unsaturation percentages are taken on two combined fractions; the first of those distilling up to 200 deg. C, and the second those from 200 deg. to 275 deg. C (both under atmospheric pressure).

(c) Settling points (instead of cloud tests) are taken on the "vacuum" fractions. The setting point tests afford a basis of direct comparison (for content of solid paraffin) with commercial oils produced from shale in Scotland.

Then follow five tables, giving complete data of distillations of shale oil produced in Scotland, shale oil from Scotch shale but produced in the assay retort (without steam), shale oil from Utah shale in 2-hour run, shale oil from Utah shale in 5-hour run, and distillation analysis of Pennsylvania petroleum for comparison, none of which can be reproduced because of lack of space. The last or sixth table is given, since this is the only one giving a direct comparison of the results of the five oils covered in the five tables, which are omitted:

Table 6

Comparison of shale oils made in assay retorts, Scotch shale oil, and Pennsylvania petroleum

Source of oil	Scotch shale	Scotch shale	Shale from Soldier's Summit, Utah	Shale from Soldier's Summit, Utah	Pennsylvania crude
Retort	Scotch Commercial	Assay	Assay	Assay	....
Retorting time	....	2 hours	2 hours	5 hours	....
Yield of oil		18.1	42.75	40.2	
Specific gravity of oil	0.877	0.864	0.896	0.882	0.812
Setting point of oil, °C	28	32	33.5	33	*
Distillation, first drop, °C	49	44	42	40	26
Percent distilled to 200°C	12.22	16.63	15.09	18.81	31.93
Unsaturation, 200° C fraction, percent	28.0	29.4	42.6	39.2	4.4
Percent distilled, 200°-275°C	23.22	20.47	19.18	20.10	20.83
Unsaturation, 200° - 275°C fraction, percent	34.0	34.1	43.3	40.2	3.6
Vacuum fraction to 200°C,					
Percent	9.32	2.10	3.02	2.64	3.33
Specific gravity	0.872	0.868	**	**	0.826
Viscosity	38	38	**	**	39
Setting point, °C	*	*	*	*	*
Vacuum fraction 200°-225°C,					
Percent	5.27	4.38	8.56	7.80	7.75
Specific gravity	0.881	0.872	0.892	0.880	0.832
Viscosity	40	41	41	42	40
Setting point, °C	*	*	*	*	*
Vacuum fraction 225°-250°C,					
Percent	7.16	5.88	9.87	9.20	6.02
Specific gravity	0.892	0.874	0.899	0.889	0.841
Viscosity	46	43	48	48	45
Setting point, °C	24.5	21.5	21.5	18	15.5
Vacuum fraction 250°-275°C,					
Percent	6.13	7.30	10.75	14.90	5.37
Specific gravity	0.902	0.894	0.918	0.906	0.848
Viscosity	52	50	61	58	51
Setting point, °C	29	29	32	31.5	22.5
Vacuum fraction 275°-300°C,					
Percent	6.07	9.45	10.90	8.88	5.16
Specific gravity	0.911	0.898	0.932	0.928	0.859
Viscosity	60	60	83	72	67
Setting point, °C	34	37	40	40	30

* Not determined.
** Combined with next higher cut.

Comparison of Oils by Distillation Analysis

Table 6 is a tabulation of some of the properties of the oils whose analyses appear in Tables 1 to 5. It will be noted that the distillation analyses indicate:

(a) The oil made from Scotch shale by the assay retort is somewhat superior to that produced commercially in Scotland, except as regards a small unsaturation percentage.

(b) The oil produced from the Soldier's Summit shale by the assay retort is nearly equivalent to that made from Scotch shale both by commercial operations in Scotland and by the assay retort in the laboratory, except as regards percentage of unsaturation. This is a quite important point, as unsaturation percentage is an indication of the relative magnitude of refining losses. The Soldier's Summit shale oil apparently contains a higher percentage of paraffin wax than the other oils examined, as indicated by setting points of the crude oils and the percentages and setting points of the vacuum fractions.

(c) The 5-hour retorting period produced a lower yield of oil than the 2-hour run, but the quality of the oil produced was somewhat better. The slight difference in quality is largely offset by the greater yield of the shorter

* Dean, E. W., Properties of typical crude oils from the eastern producing fields, Bureau of Mines, Reports of Investigations. Serial No. 2202. Jan., 1921. 57 pp.

run, and also by the actual saving in time, fuel, etc., in making a retorting test.

(d) The Pennsylvania crude is superior to the shale oils except in paraffin content, as indicated by setting points.

It is interesting to know that the best oils thus far produced in the laboratory from both Scotch and American shales have been made in the assay retort. In no case, by any retort thus far used in the laboratory, have oils been made from American shales that are fully equal in quality to Scotch shale oils.

Production of Shale Oils With Steam

Many believe that the use of steam retorts will improve the quality of oil produced and that oils of good quality can not be made without the use of steam. The above tables indicate that the assay retort, without using steam, produces an oil from Scotch shales as good as that produced from the commercial Scotch retort in which steam is used. In designing the assay retort it was hoped that oil of good quality could be produced without the use of steam, as the equipment necessary to generate and use steam would have greatly complicated the apparatus and made it difficult to operate in the field. The assay retort has never been operated with steam, but it is not unlikely that the use of steam in it would slightly increase the quality of the oil it produces. Studies now under way may give evidence to this effect.

Many experiments have been made, however, with larger retorts in which steam is used, varying the amount of steam and rate of heating. So far the use of steam in any of the retorts dealt with has not raised the quality of the oil produced to that produced by the assay retort. Later studies with more favorable conditions may, of course, show great improvement by the use of steam. The point is emphasized, however, that the assay retort without steam, produces the best oil thus far made by the Bureau of Mines from American shales. It also produces, from Scotch shales, oil practically equivalent to that produced from the same shales in commercial operations in Scotland, in which steam is used. The assay retort should, therefore, be highly desirable for use in determining both quantities and qualities of oil to be obtained from American shales.

The above must not be taken to indicate that the use of steam in commercial retorts is not necessary or desirable. The assay retort embodies principles that can not be so fully utilized in retorts of commercial size because of their practical limitations. Since these principles can not be fully applied in commercial types of retorts, the authors believe that the use of steam or other gases, in many cases, may be necessary to substitute for them. What these principles are and why the use of steam may largely replace them in larger retorts, can not be discussed in a report of this length.

Insasmuch as Scotch shale-oil plants have been operating successfully, and in continuously increasing numbers, since 1871, with a production gradually increasing to two million barrels (84,000,000 gals.) a year, it is apparently only a question of a sufficient demand at an adequate price for the increased supply of oil, to bring about active invasion of this field by our most able oil men with adequate finances. Considering the billions of gallons of oil and the amount of motor fuel which this means, it is apparent that American motor vehicle manufacturers have little to fear on the score of future fuel supplies.

1922 Auto Shows to be Record Breakers

That the automobile shows of next winter in New York and Chicago will be bigger than ever was evidenced by the unusual interest shown in the exhibitions and by the large number of car manufacturers who drew for exhibition space at the offices of the National Automobile Chamber of Commerce. No less than 94 different makes of cars will be displayed at the Grand Central Palace, New York, from January 7 to 14, while 80 makes will be shown in the Coliseum and Armory, Chicago, Jan. 23 to Feb. 4. This is a record number of exhibitors. First to draw for space was the Buick Motor Company.

The shows will bring out for the first time a number of cars never before displayed at the national shows, among them being the Rickenbacker, Durant, Wills-St. Claire, Bournonville, Kelsey, Handley-Knight, Itala and Vauxhall, the latter two being of foreign manufacture.

The following makes of cars will be on display at the New York show: Ambassador, Anderson, Apperson, Auburn, Bournonville, Briscoe, Buick, Cadillac, Case, Chalmers, Chandler, Chevrolet, Cleveland, Cole, Columbia, Commonwealth, Crow-Elkhart, Davis, Detroit Electric, Dixie Flyer, Dodge Brothers, Dorris, Dort, DuPont, Durant, Elcar, Elgin, Essex, Franklin, Gardner, Grant, Handley-Knight, Hanson, Hatfield, Haynes, H. C. S., Holmes, Hudson, Hupmobile, Itala, Jackson, Jordan, Kelsey, King, Kissel Kar, Kline Kar, Lafayette, Leach Biltwell, Lexington, Liberty, Lincoln, Locomobile, McFarlan, Maibohm, Marmon, Maxwell, Mercer, Milburn, Mitchell, Monroe, Moon, Nash, National, Noma, Oakland, Oldsmobile, Overland, Packard, Paige, Paterson, Peerless, Pierce-Arrow, Pilot, Premier, Rauch-Lang, R & V Knight, Reo, Rickenbacker, Roamer, Saxon, Sayers, Standard, Stanley, Stearns-Knight, Stephens-Moline Plow Co., Stevens-Duryea, Studebaker, Stutz, Templar, Vauxhall, Velie, Westcott, Wills-St. Claire, Willys-Knight.

All of these cars will be displayed at Chicago also with the exception of the DuPont, Kline, Ambassador, Noma, Leach-Biltwell, Hatfield, Bournonville, Essex, Rickenbacker, Kelsey, Itala, Vauxhall, Stanley.

Closed-Car Show

An exhibition of closed motor cars will be held during the week of Nov. 14 to 19 in the Twlefth Regiment Armory, Columbus Ave. and Sixty-second St., under the auspices of the Automobile Dealers' Association of New York. Sanction for the show has been granted by the National Automobile Chamber of Commerce.

It is expected that about 200 cars will be displayed, including many of the latest coupe and sedan models. The following makes will be among the exhibits: Packard, Oldsmobile, Haynes, Maxwell, Premier, Standard, Stephens, Cadillac, Sheridan, Scripps-Booth, Chalmers, Liberty, Hupmobile, Willys-Knight, Hudson, National, Paige-Detroit, Daniels, Templar, Overland, Dixie, Marmon, Durant, Roamer, Crow-Elcar, Nash, Dodge, Peerless, Studebaker, Mercer, Franklin, Jordan, Ford, Buick, Reo, Cole, Mitchell, Moon and Essex.

The show committee comprises C. H. Larson, chairman; W. A. Woods, W. C. Poertner, A. G. Southworth, L. J. Eastman and Harry S. Houpt.

Auto Exports Gain in September

Automotive products exported in September showed an increase of slightly more than 9 percent over August exports, the first time this year that any monthly shipments have been in excess of the previous month. All automotive products, with the exception of cars, which showed a decrease of 2 percent in number, gained in September over August.

The total number of trucks shipped in September was 472, valued at $481,664, as against 381 in August, valued at $434,052. This is a gain in number of 23 percent and in value of 11 percent. The gain in September over August is greater than the gain of August over July, which was 12 percent in number and 6 percent in value. The total gain of September over July in point of number is 39 percent, and in value 53 percent. Compared with September of last year, of course, the figures this year show a decrease. During the month of September, 1920, 1,747 trucks were shipped, valued at $3,035,028. Comparison between the total shipments from January 1 to September 30, 1920, with the same period for 1921 shows a decrease of 73 percent. This accumulative decrease in terms of percentage up to September compares with the accumulative decrease up to August for eight months and up to July for seven months. The comparative decrease for the seven months up to July was 72 percent in number and 72 percent in value. For eight months, at the end of August, the decrease was 72 percent in number and 74 percent in value, while in September the showing was 73 percent in number and 74 percent in value for the nine months' period. These figures show that the bottom in truck exports has probably been reached.

Car Exports Show a Slight Decrease

Car exports show a decrease of 2 percent in number and 17 percent in value in September over the month of August for 1921. The greater decrease in the value of cars shipped is almost entirely due to price reductions. The comparative accumulative analysis for stated periods tells the same story in the case of cars as with trucks. During the month of September, 1920, 10,432 cars, valued at $12,550,796, were exported. This September the number exported was 2,197, valued at $1,870,770. In terms of percentage, this is 79 percent in number and 85 percent in value. Compared with the nine months' period of 1920, cars show a decrease of 78 percent in number and 78 percent in value. In August for eight months the showing was 80 percent in number and 78 percent in value, while in July the accumulative total for seven months was in number 78 percent and in value 77 percent. For the past three months car exports have hovered around the same figure, which indicates that the market has probably reached the bottom, and that the turn upward has been made, for reports received are to the effect that stocks on hand are being decreased. It must be borne in mind that greater stocks of passenger cars were accumulated than trucks, and consequently it will take longer for passenger cars to show increased exports than trucks.

The improvement in truck shipments is usually good, but it is debatable whether the gain made in September over the month of August will hold. In September parts to the value of $2,570,860 were exported, while in August $1,786,886 were shipped, a gain of $783,974, or 30 percent. Motorcycles also showed an increase in September over August; shipments amounted to 215, valued at $60,146. while in September 627 machines were exported, valued at $151,380, an increase in number of 191 percent and in value of 152 percent. For several months the motorcycle market has been very low. Whether these figures presage a quick return to the great shipments of 1920 remains to be seen, but it is probable that for some time to come the volume will not be duplicated. In September of last year, 1,841 motorcycles were exported, valued at $556,217.

Principal Markets

Japan was the largest buyer, in point of numbers, of commercial vehicles during the month of September, but Canada was first in value taken. Japan took 102 trucks, valued at $55,256, while Canada took 95, valued at $117,000. Mexico continues to be among the big buyers, both in number and value, being third, with 72, valued at $51,031. The United Kingdom is fourth, with 54, valued at $79,674. The unit value of trucks shipped to England has generally been high.

Mexico was the largest buyer of cars, both in number and value. During September, 507, valued at $398,145, were shipped. Canada continued to be a large buyer, with 339, valued at $378,765. There was a gratifying increase in shipments to Australia during September; 334, valued at $313,828, were shipped in that month. This compares with 162, valued at $154,285, in August. The increase in the Japanese shipments is very great as compared with August, when but 28 were shipped, valued at $31,122, while in September 211 were shipped, valued at $103,807. British India showed an improvement in car shipments over August, the figure for ths latter month being 23 in number, valued at $12,736, as compared with 56, valued at $64,160, during the month of September. There was a noticeable drop in the shipments to the Dutch East Indies, these having fallen from 117 in August to 42 in September. Cuba, which was one of the largest buyers in 1920, continues to buy but a nominal number, September showing an increase of only 2 over the August figures, which was 85.

The following table gives the comparative export figures for September of 1920 and 1921, in number and value, of trucks and cars, as well as the value of parts:

COMPARATIVE FIGURES OF EXPORTS FOR SEPTEMBER, 1920 AND 1921

Cars and parts	September, 1920 Number	September, 1920 Value	September, 1921 Number	September, 1921 Value
Commercial:				
Complete cars	987	$1,721,473	239	$ 238,610
Chassis	760	1,313,555	233	243,654
Total commercial	1,747	3,035,028	472	481,664
Passenger:				
Complete cars	9,632	11,708,629	1,631	1,493,019
Chassis	800	842,167	565	377,751
Total passenger	10,432	12,550,796	2,197	1,870,770
Parts of, not including engines and tires	....	7,311,951	....	2,570,860
Total automobiles and parts of	....	22,897,775	....	4,923,294

Ford September Output

Ford Motor Co.'s September production of domestic and foreign plants was 97,651 passenger cars and trucks. Of this 2,937 were made in Canada and 4,525 at other foreign plants. In addition, 827 tractors were turned out.

All Ford assembling plants are in operation. September output at Detroit of 7,408 vehicles was highest. Kearny was second with 7,036, followed by Chicago with 6,000 and St. Louis with 5,525. October schedules call for total output of 90,000 cars

Modern Upholstering for Fine Motor Cars--III

Methods and Materials Employed in Enclosed Cars, Especially the Smaller Limousine and Larger Coupe

SIMPLICITY marks the modern or up-to-date enclosed car, and in so far as this is possible, considering the class of buyers to whom the car appeals, economy as well. A very prominent body engineer has summed up the situation in this respect very succinctly. He stated relative to upholstery that the straight or French pleat continues to deserve favor in the trimming scheme for enclosed bodies, and that closed bodies have less ornamentation than formerly, with the common omission of toilet or vanity cases and flower holders. Leather or fine fabrics for seat and back coverings is usual but imitation leather is being used for the flats and backs of the front seats, or where possible, carpet, in the interest of economy. One dome light and at times, corner reading lamps,

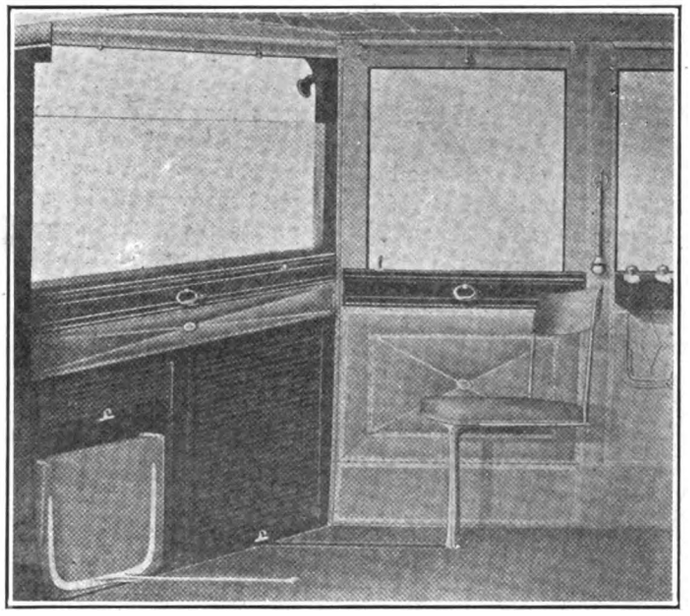

Fig. 12. Interior of a French limousine showing slightly different treatment of the side panels and inside of the doors.

constitute the sole appointments outside of the instrument board.

In what follows the upholstering of the small limousine or large coupe will be described and illustrated, working along these simple and economical lines. The round cornered limousine, with domed roof and enclosed drive, differs from the landaulette recently described (September issue, pages 14 to 17) in that the trimming procedure is changed through the lack of a folding head. Having no folding head to upholster, there is no head leather, and the construction of the head lining is changed. Otherwise, the trimming follows along the lines which have been described, and the notes below represent, as did the former notes, largely British practice. It will be of assistance, in all probability, for the reader to refer as well to the initial article on trimming, which appeared in the August issue, on pages 7 to 11, inclusive, and in which the various types of upholstery were described and illustrated, in detail.

For our purpose we propose to deal with a round corner dome roof limousine of the enclosed drive type; our illustration, Fig. 11, will give a general idea of the style as it shows an outline of the whole of one side of the body without the front seats and furnishings. The body has a door on either side in the center of the body; the driver's seat is fixed; the near side seat is of the revolving type to give access to the front part of the body. A squab deep and full is provided for the back seat, also a deep cushion; the near side seats and that of the driver are provided with compact but comfortable squabs and cushions. Frameless lights are fitted to the body, and it will depend upon the type of these if glass strings are required.

Materials Required

The materials required are 15 yards of cloth, if the whole is trimmed with cloth; if the body should be trimmed with leather four hides are required, with 5½ yards of cloth for roof, quarters and pillars, 6 yards of sail canvas, 3 yards of hessian canvas, 12 yards of wadding, 10 yards of calico, 6 yards of linen or other material for covering the seats, cushion bottoms, and lining the pockets, 4 yards of broad lace for glass strings if required, 7 yards if armholes are fitted, 45 yards of seaming lace, 50 yards of pasting lace, 30 lbs. of horse hair, 18 yards of common webbing, 1½ gross of buttons, 4 yards of carpet, 8 8 in. No. 12 springs, 16 6 in. No. 12 springs, 16 4 in. No. 12 springs, curtain barrels, curtain cord, lute string, door pulls, glass string slides, knobs, guards, the usual fitments known as companions, and roof lamps as required.

Starting the Work

First mark out the whole of the body for the lace lines, for the waist rail and bottom line above the carpet, also the lace line along the sides of the roof sweeping round the sidelight as shown in the sketch; mark a line for the depth of the back squab, which should be at least 30 inches deep; mark a line at the front of the back quarter, which should be in such a position as to allow for a pocket about 7 ins. wide with a suitable margin on each side to blend with the door pocket; the pocket in the front part of the body is the same dimension as the back pocket, leaving the remainder of the quarter for a half-diamond squab. On the driver's side an imitation pocket is fixed to avoid hindrance to the working of the levers. There is no broad lace on the body, only for glass strings; the pocket and flap with its margins take up the space between the waist rail and carpet line on the door; the waist rail is back tacked into the seaming lace all round the body. There is no pasting lace across the pocket flaps, only round the squabs and along the top of the back squab, but pasting and seaming laces are carried round the sides and front of the roof, and round in a sweep at the back of the side light. Note the seaming lace edge around side and door panels in Fig. 12.

After this has been arranged, fit the canvas for the squabs, and buckram for the pockets. After fitting, lay the back squab canvas on the bench, and mark a line 3

ins. above the top line to allow for the springs; add 1 in. each end at the top part of the squab to nothing at the bottom to allow for contraction; then mark a line 7 ins. down from the new top line, and another 4½ ins. below that, and another 5 ins. from the bottom; mark off along these lines for 4 in. pipes and half diamonds; also mark out the quarters for 3½ in. pipes and half diamonds. The top row of buttons should be 4 ins. from the top, the bottom of the half diamonds 4 ins. below that; it is possible that no bottom buttons will be necessary in the quarter squabs. The back quarter squabs and the near side front squabs are fitted with a roll under the material to form an elbow rest. If there is convenient room on the driver's side, the same can be done there, but usually the prominent elbow is in the way at this part of the body; in marking out the front seats, allow 1½ ins. extra in depth for springs; mark the top buttons 4½ ins. down, the half diamond 4 ins. deep, and the bottom buttons 4 ins. from the bottom pipes, and the half diamond 3½ ins. wide; also cut out pieces of buckram for the pockets and flaps; these are of the required size to suit the body.

The Back Squab

To mark out the material for the back squab allow 1½ ins. across the pipes, 1½ ins. between the bottom buttons and the bottom half of diamonds, nothing between the half diamonds, 3 ins. above the top buttons, and 1 in. at the bottom, but allow sufficient at the ends to stuff up nice and full. For the quarters allow 1 in. across the pipes, nothing in the half diamonds from top to bottom, and 3 ins. at the top to allow for the prominent elbow. For the small squabs or the front seats allow 1 in. across, ½ in. in the half diamond, and ½ in. between the bottom of the half diamond and bottom buttons, 1½ ins. at the top, 1 in. at the bottom, and 1½ ins. at the ends.

The Roof Cloth

If the cloth has not any pronounced lines, the roof cloth can be cut out in one piece from the front to the back, down to the back squab. the lace line round the side light being determined by the width of the cloth; the roof cloth is then fixed up to the roof by strips of calico attached to the cloth by rubber solution; at the rounded part of the roof the cloth is fixed to strips of canvas stretched and tacked to the roof sticks; this must be done very carefully and neatly to make a good job of this part, the quarters being fixed in separately. See also, the unusual roof stitching shown in the French limousine, Fig. 12.

The pockets are made up with a single gusset stitched on to a piece of material the size of the door; a strip of linoleum or enamel leather is fixed in place between the material to form a rand or ornament; if preferred this can be of some ornamental design, or another method, that is often used, is to fix in half round beads of guttapercha. The pockets and flaps are welted with either ferret or lace, or if the body is trimmed with leather they look well welted with the same leather.

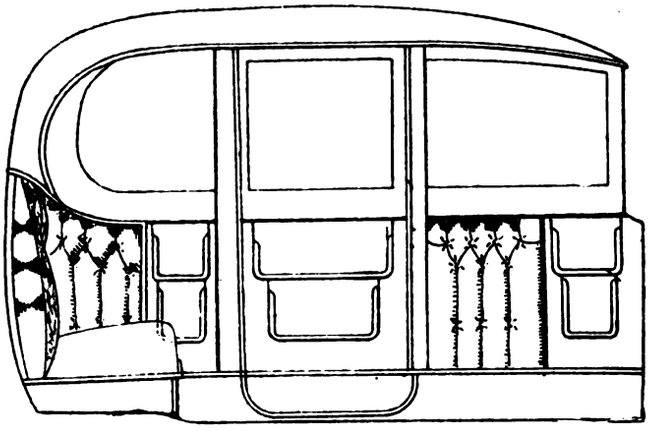

Fig. 11. Sketch showing the type of upholstering and car described herewith, a rounded corner limousine.

After the roof cloth has been fixed in, the back quarter squabs can be fixed; these can be stuffed in the body; the back canvas is stretched in tight and flat, and a canvas roll is fixed in along the top of the squab about 2 ins. thick between the canvas and material to form the elbow; this roll is stuffed up firm and quilted to ensure its keeping its shape. After the quarter is stuffed up, the springs are fixed for the back squab, one row of 8 in. springs about 12 ins. from the bottom, another row of 6 in. springs about 6 ins. above, the top row of 4 in. springs 6 ins. again above; the back squab is then fixed in, being stuffed to form a nice full top, pasting and seaming lace being fixed round the back and quarters in one length from one hinge pillar to the other. Proceed then with fixing the quarter pockets and trimming the doors, front quarters and front pocket and dummy pocket and all pillar pieces; the pillar pieces all carry down from the roof to the carpet line.

The driver's seat is made up by nailing in the squab over one row of 6 in. springs fixed half-way up and a

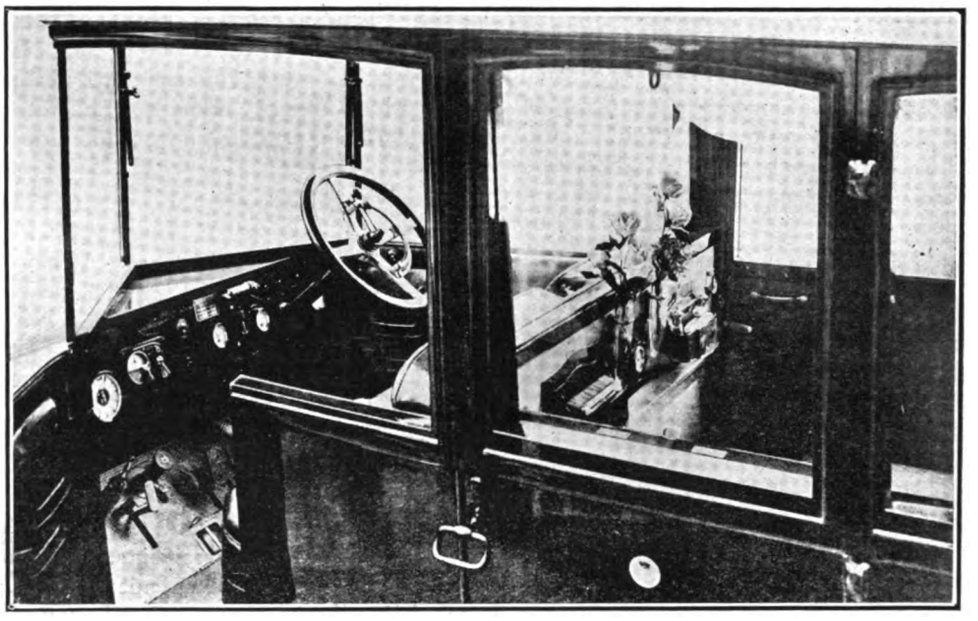

Fig. 13. German limousine showing a more liberal use of interior fittings and equipment, also a smooth type of leather upholstering for the front seats.

row of 4 in. springs 6 ins. above; an important point to remember is to make up the seat and squab so that the occupant does not get undue pressure on each shoulder but rather an even pressure all over.

The revolving seat is made up with an iron frame at the back which folds over the cushion, and the squab is securely fixed to this, the cushion being fitted up on the wooden bottom part.

All carpet pieces may now be put in and a carpet fitted for the bottom of the body; fix seat valances, door stops, and all necessary furnishings, which consist of curtains, hand holders, hand pulls, door pulls, guards, etc., which will complete the job. Fig. 13 shows the unusually complete equipment of a German Mercedes limousine.

Body Builders' National Exhibit

The first annual automobile body builders' show by the Automobile Body Builders' Association, headquarters of which are in the Woolworth building, New York City, is planned to be held in New York in the Twelfth Regiment Armory the week of the national automobile show, Jan. 9-14.

The exhibits will consist of passenger and commercial into their construction, trimming and finishing. Primarily, however, it will be an exhibit of those manufacturers supplying bodies in quantities to car builders.

It is the intention of the Body Builders' Association to make this show an annual affair. Since the principal participants will be those body builders furnishing bodies in quantities to the automobile builders, the idea has good possibilities of being worked up into an exhibition of value and interest.

The opportunity to exhibit will not be confined to members and associate members of the association, but will be extended to those to whom special invitattions are being sent. In this respect the show will be an opportunity of establishing or maintaining business relations with automobile builders, body builders and others interested in seeing body materials and products and having their merits personally explained.

The association is planning a big, artistically decorated show ,and has made a generous appropriation to this end. A committee on floor plans has tentatively planned the locating of exhibition spaces, and the scheme of interior decorations, which are described as being very elaborate.

Carriage Industry in Southampton, Eng.

The following reference to the old industry in a once famous center appeared in the Hampshire Independent, and is not without interest:

Carriage building was one of Southampton's principal industries sixty years ago, but the coming of the motor has strangled it. The famous factory Above Bar established by Richard Andrews has recently passed into the hands of a motor firm, but in the days of which we write the Royal Carriage Factory, as Andrews was termed, advertised that it had "five hundred of the newest designs to select form of landaus, sociables, broughams, basternas, wagonettes, open with canopy and solid tops; and raglans, Eugenie, Albert, Victoria and George the Fourth phaetons; pilantum, elcho, Albert step-piece barouches; cabriolet Victorine, half headed and open phaetons; four wheel, two wheel and every description of dogcarts." There were testimonials from "1,000 of the first families," and also "from every part of the globe." Besides Andrews' there were also in Above Bar, Aslatt's factory at the corner of the George Inn Yard; Jones's, now occupied by Messrs. Waller and King, auctioneers; and Aslatt's at the Weighbridge, and in West Marlands. Outside the latter was a large iron plate on the public land, on which the workmen used to fix the redhot tires on the wooden wheels. There were other coach factories of smaller dimensions in different parts of the town, but those we have named gave employment to a large number of hands.

Forty-ninth C. B. N A. Convention

The forty-ninth annual convention of the National Carriage Builders' Association was held at the Hotel Gibson during the week of September 19 with a representative gathering of members from all sections of the country in attendance.

Officers of the association and other prominent members of the body who were speakers at the various sessions, predicted a big revival in the carriage industry during the next several years, asserting the receding scale of living will mean a return to more economic methods of transportation. There has already been a notable increase in the demand for buggies from the south, where farmers, hard hit by economic conditions, have abandoned the automobile and returned to horse and buggy, feeling they require a horse on the farm anyway.

The Carriage, Harness and Accessory Traveling Men's Association held its thirty-first annual convention at the Hotel Gibson during the week.

The C. B. N. A. conducted an exhibition in the basement of the hotel during the days of the combined conventions.

An extensive entertainment was provided by local members of the industry for the visiting delegates and their families.

Officers of the National Carriage Builders' Association elected for the ensuing year included P. E. Ebrenz, St. Louis, president, and George W. Huston, Cincinnati, secretary and treasurer. The other officers chosen were: Vice-presidents, Thomas J. McNamara, Cincinnati; W. L. Delker, Henderson, Ky.; W. C. Heitzman, Union City, Ind.; W. G. Norman, Griffin, Ga.; J. H. Birch, Jr., Burlington N. J.; B. F. Taylor, Oxford, N. C.; T. M. Robinson, Nashville, Tenn., and L. R. Jones, Franklin, Va. Executive committee, F. H. Delker, Henderson, Ky.; C. R. Crawford, St. Louis; T. M. Sechler, Moline, Ill.; H. A. White, High Point, N. C., and R. J. Jones, Henderson, N. C.

The next convention, which will mark the fiftieth anniversary of the organization, will be held either in Cincinnati or St. Louis, announcement to be made by the executive committee at a later date.

Solders for Aluminum

All tests on recent aluminum solders have been completed by the Bureau of Standards and Circular 78, "Solders for Aluminum," will now be revised to include these tests. In spite of claims made by those interested no solder for aluminum has yet been found which will withstand the corrosion test, although the fused zinc chloride solders resist it for the greatest length of time.

Recent Trolley Bus Developments

Showing the Economical Field of Operation of a Special Electrically-Driven Truck Chassis; Results of Test Runs—New Field Opened Up

BY K. A. SIMMON*

SEVERAL very successful demonstrations have been made in Detroit, Mich., of a trolley bus, using electric equipment furnished by the Westinghouse Electric Mfg. Co. This is really a Packard truck chassis, electrically driven through a pair of electric motors instead of the usual gasoline engine.

During the demonstrations which of necessity were of a preliminary nature, as only a limited amount of double contact overhead was available on the Municipal Railway Company's right-of-way, the trolley bus was operated at various speeds up to approximately 23 miles per hour. The acceleration of the vehicle proved to be very smooth and rapid. It was capable of operating at a high rate of speed, even though the center of the vehicle was more than 10 feet to the side of a point directly beneath the contact wires. The ease with which the vehicle could dodge large trucks directly in its normal path, or draw up to the curb to receive or discharge passengers, was astonishing.

While ultimate service with the trolley bus would undoubtedly not include turning around without a loop, it was very gratifying to note that it was possible to make a complete turn of the vehicle, or to "Y" the vehicle in the same way that an automobile or gas bus is turned on a narrow street. During this operation it was only necessary to shift the trolleys once, a method of operation heretofore thought impossible with two trolley poles, but a feature which is extremely advantageous in the case of an emergency, such as might occur due to a fire or a similar street blockade.

Design Follows That of Gasoline Vehicles

Contrary to the design of previous vehicles of this class, the Packard trolley bus follows gasoline bus design rather than street car design. The body is set comparatively low and is arranged to seat 25 passengers with considerable space available for standees. The bus which is now on demonstration has a floor approximately 2 inches higher than the floor of the safety car and two steps are provided; however, the construction is such that the floor can readily be lowered several inches and a single step used. The body is approximately 24 feet long and 8 feet wide.

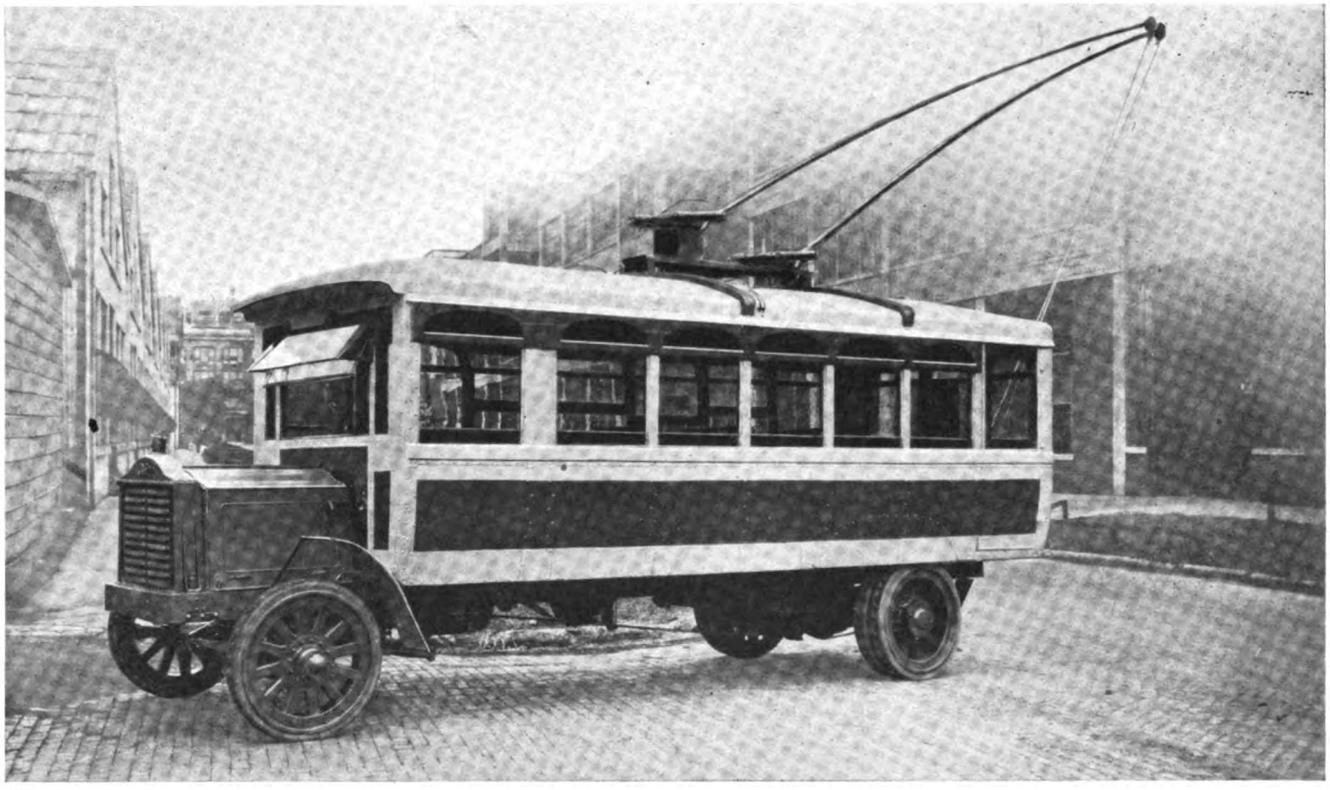

Fig. 1. General appearance of the new Westinghouse-Packard trolley bus, a truck chassis with electric motors in tandem furnishing the power.

The complete vehicle including trolleys with 18-foot poles as shown in Fig. 1 weighs 11,500 lbs., of which weight 6,770 lbs. is carried on the rear axle. The chassis is of standard Packard type ED design with such omissions as are necessary to accommodate electrical instead of gasoline equipment. The propulsion equipment consists of two 25 h.p. Westinghouse ball-bearing safety car motors mounted in tandem and coupled together and to

* Railway Department Westinghouse Electric & Manufacturing Company.

The front axle is drop-forged and has an I cross section. The steering knuckles are of the inverted yoke type. The rear axle is a built-up structure arranged so that the weight of the vehicle is carried on heavy steel tubes fastened to the housing. The torque of the propulsion motors is transmitted through the propeller shaft to the worm with a total gear reduction from the motor to the wheels of 7¾ to 1.

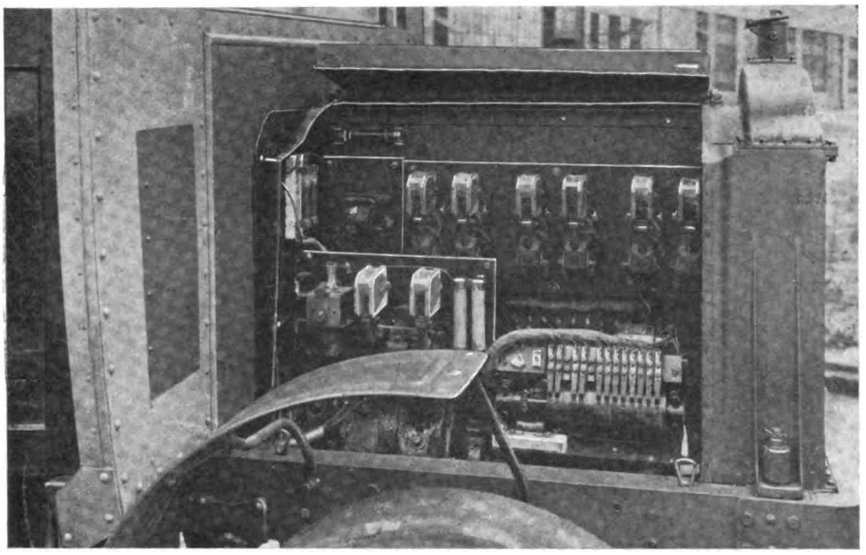

Fig. 2. Right side, under the hood, showing electric control units and a small part of one of the big motors.

The worm, which is mounted directly above the worm-wheel and the differential, are mounted as a unit in a cast steel carrier bolted in place in the center housing of the axle. The axle drive shafts are arranged so that they transmit torque only and do not carry any of the direct load. Tubular radius rods remove driving strains from the springs. The service brake consists of two contracting shoes operating on a single drum at the rear of the transmission. The emergency brake consists of two sets of internal expanding segments acting on steel drums on the rear wheels.

The wheels, which are equipped with special rubber cushion tires, are 34 inches in diameter, which diameter results in a free running speed of approximately 22 miles an hour, with a gear reduction of 7¾ to 1.

The chassis complete with motors, control apparatus and resistor weighs 7,190 lbs., there being almost an equal distribution if weight on the front and rear axles. It is interesting to note in this connection that even though rather heavy motor suspension castings are employed the electrical equipment which has a normal rating of 50 h.p. and is capable of developing extremely heavy torque at slow speeds, weighs approximately 175 lbs. less than the gas propelled engine equipment for the same size chassis.

Foot Control Is Employed

The control equipment is of the foot operated type and is arranged for automatic acceleration. The notches are provided on the foot controller so that it is possible to arrest the controller at a slow or "switching" speed for travel in dense traffic or at the series or half-speed position. On account of variations in tractive effort required, a unique control operating scheme has been devised. The unusual grade and load conditions to be met may necessitate that some accelerations be made at double the normal accelerating tractive effort. A small motor-driven sequence switch controls the operation of the resistance notches as well as the transition from series to parallel while the speed of this small sequence switch motor is directly affected by current in the propulsion motors.

The control apparatus includes two small electrically-operated line switches complete with overload trip, six small resistance and transition switches, a foot controller, a manually-operated reverser, a motor cutout switch and a set of starting resistors. All of this apparatus is mounted beneath the usual engine hood, the resistors being mounted one side of the center line whereas the circuit interrupting devices and other important control items are located on the other side where they are ventilated, yet protected from the weather as shown in Figs. 3 and 4. The partition dividing the hood into two compartments is of a heat resisting insulating material which acts as a switchboard for the control apparatus. The reverse lever and overload reset lever project through the dash at a point convenient to the driver.

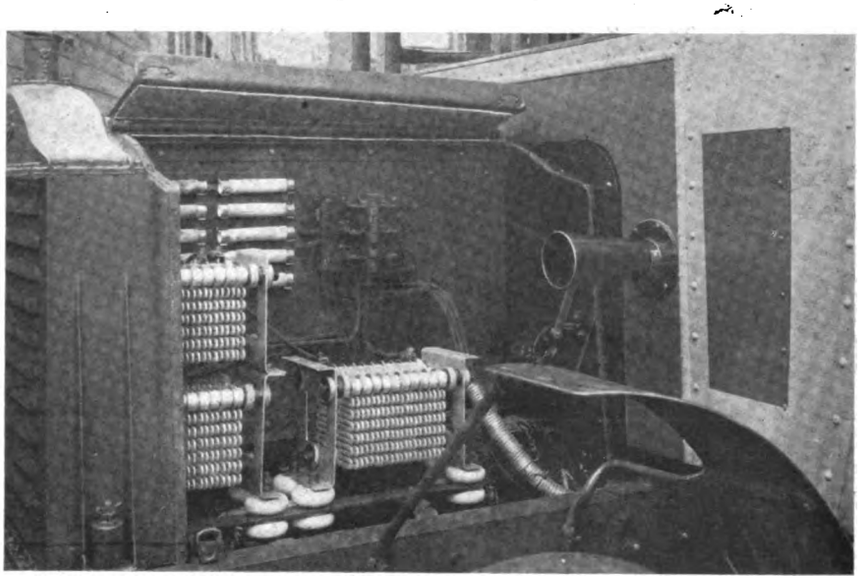

Fig. 3. Left side, beneath the hood, showing the starting resistors, other electric equipment, and the heat-resisting insulating partition.

Nothing has been said so far regarding the current collecting device and while the "final answer" is not yet available the equipment on this bus has performed phenomenally well. It consists of two separate wheel trolley bases with 18-foot poles, swivel harps and 5-inch diameter trolley wheels having U-shaped grooves. The trolley bases are both mounted on the longitudinal axis

one 30 in. back of the other, the front base being elevated 10 in. above the rear base. This arrangement, with the board to which the trolley bases are attached approximately 11 ft. from the ground, permits of a comparatively large "cruising radius."

The preliminary test runs to date indicate:

(1) The desirability of having ample motor capacity for comparatively high rates of acceleration and a free running speed comparable with the speed of other city transportation vehicles.

(2) The advantage of a foot control having a single simple motion from the off to the full speed position. In this way the operator can give his entire attention to the driving of the vehicle and has both hands available for steering.

(3) The importance of efficient brake equipment.

(4) That electrically propelled trackless vehicles appeal to the public as a bus, and they should be designed along bus lines.

(5) That the economical field for the trolley bus appears greater than formerly presumed.

(6) That the major problem in the development of this form of transportation for the American city lies in the selection of the proper overhead construction and in the development of suitable collecting devices.

(7) The importance of immediate standardization of the distance between contact wires so as to avoid non-interchangeable vehicles and unnecessary development.

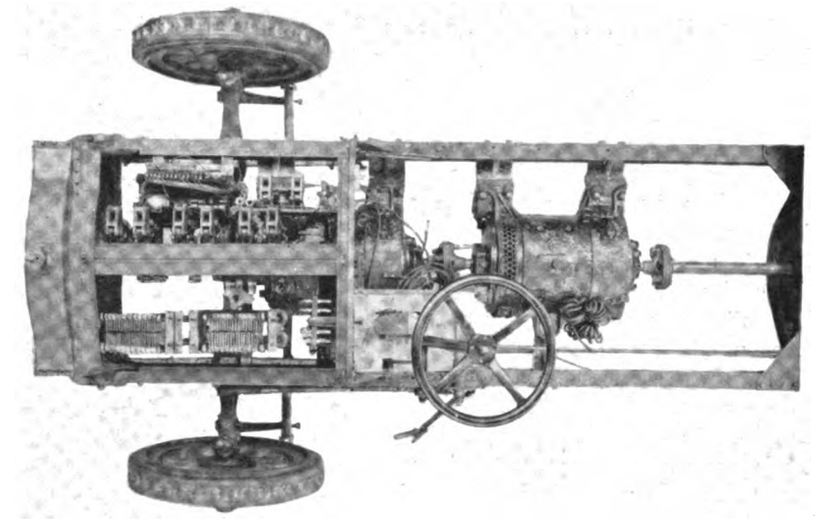

Fig. 4. Forward end of trolley bus chassis from above, indicating tandem arrangement of the two electric motors, and disposition of the other units.

The Field of the Trolley Bus

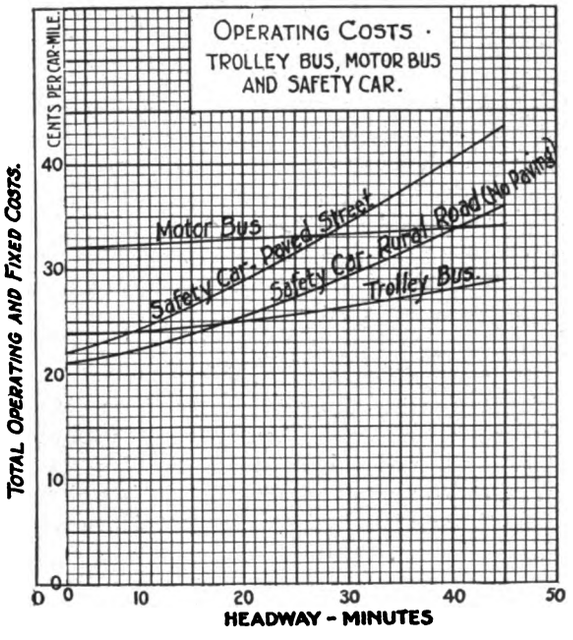

Fig. 5. Chart showing operating costs of three forms of transportation, plotted against headway in minutes.

Probably one of the most discussed questions relative to trolley bus operation is the "economical field."

There are many elements that enter into a question of this sort, some of the more important are the following:

(1) Available existing transportation.
(2) Rural or paved roads involved.
(3) Condition of existing roads.
(4) Density of passenger traffic.
(5) Yearly tax burdens for buses.
(6) Labor and material costs.
(7) Power equipment available.

We all realize that the taxicab or "service at call" vehicles, the gas bus, trolley bus, safety car or double truck car, all have an economical field and in order to obtain a picture as to the field of the trolley bus let us make some assumptions and then compare the transportation of human freight by gas bus, trolley bus and safety car.

Possibly the best comparison would be obtained if we compare the total fixed charges and the operating cost per car mile as a function of the number of seats supplied per hour; however, if we assume the gas bus and the trolley bus to seat 30 passengers and the single end safety car to seat 35, and make comparison between total fixed charges plus operating expense per car mile plotted against headway in minutes, we get a very interesting picture.

Assume:

Schedule speed	10 m. p. h.	
First cost of motor bus	$ 7,000	
First cost of trolley bus	8,000	
First cost of safety car	6,250	
Mile of city paved single track	50,000	
Route mile of city paved double track	90,000	
Mile of rural improved single track	30,000	
Route mile of rural unpaved double track	54,000	
Mile of single 4-0 trolley construction	3,700	
Mile of double 4-0 trolley construction	5,000	
Cost of 200 foot siding	3,500	
Mile of 4-0 feeder	610	
Conducting transportation (cents per car mi.)		7.3
Power cost of safety car (cts. per car mi.)		2.5
Power cost of trolley bus (cts. per car mi.)		2.5
Gas and oil (cts. per mi.—motor bus)		6.0
General and miscellaneous expense (cts. per mile for all vehicles)		4.0

Interest and taxes calculated at ..... 7 percent

Maintenance per car mile as follows:

	Gas Bus	Trolley Bus	Safety Car
Track or road way (or road tax)	$ .01	$ .01	$ .019
Other way and structures		.0105	.006
Vehicle or car	.106	.05	.015

Depreciation as follows:

Life of vehicle.....	5 years	8 years	12 years

The curve, Fig. 5, of necessity involves many assumptions and is only approximate, yet the tendencies are self-evident. For instance:

(1) The cost of gas bus operation does not decrease materially as density of service increases.

(2) If safety car tracks are laid on a rural or improved road, the safety car ceases to be more economical than the gas bus if the headway is materially increased beyond 40 minutes.

(3) Trolley bus or safety car service is fundamentally more economical than gas bus service for frequent service due to cost of gas and high maintenance of gas engine equipment.

(4) Railless vehicles show up to advantage due to practically free use of roads, whereas rail vehicles must maintain rails and also maintain a portion of the street.

(5) Safety car transportation not involving street paving expense is more economical for service where the headway is less than 17 minutes. If paving burdens are imposed on the vehicle running on rails its economical field may be materially reduced.

Only actual trolley bus service will tell the real story as there are many unknowns that cannot be evaluated at present. It is hoped that the time is not far distant when all the facts will be known.

Germany Again Exhibits at International Shows

The German automobile manufacturers, through the medium of their press, show their satisfaction upon coming once more into competition with the manufacturers of those countries with whom Germany was recently at war. Hitherto, the Germans have been rigorously excluded from all exhibitions in these countries, but at the International Automobile Exhibition held at the Hague, competitors from America, England, France, Germany and Italy met.

The Germans claim to have maintained their reputation in point of quality, but grant that in high-class luxury bodies they have to acknowledge the superiority of other countries, particularly that of England, says Engineering Production of London. They seem to be of the opinion, however, that for practical and useful cars luxury bodies are a secondary consideration.

It is pointed out that in some respects there is a clear distinction between German construction and that of other countries. The increase in the use of front and rear wheel brakes is contrary to the German method, the internal expanding brake prevailing in all cases. While the Germans have held almost exclusively to the long extended half elliptic springs arranged above the axle, other countries have in most cases arranged the contrary; the quarter elliptic spring also has many partisans.

The contrast between the German construction and that adopted by other countries was most obvious in the formation of the radiator. The flat radiator preponderates in all countries other than Germany, but is not to be seen on any car of German make. The pointed radiator, although dearer in construction and possessing no technical advantage, indicates the intersecting line, and has been adopted in Germany.

Metal wheels are widely used, although for American cars wood is again in favor. Disc wheels are also popular.

The Germans claim superiority for their good wagon construction, and particular attention is drawn to a three-ton chassis, the simple construction of which has, it is stated, been much admired.

Motor Coach Progress

The outstanding feature of the recent commercial motor show at the Olympia, London, was the large display of motor buses, "charabancs" as they are popularly known abroad. These passenger-carrying vehicles predominated over the other commercial types of motor vehicles, and it was not surprising in view of the great advance made recently in Great Britain in the transportation of passengers by motor vehicles for fairly long distances. With the exception, perhaps, of a few localities in the far west, the majority of motor busses used in this country are still of the well-known "jitney" type, lacking many improvements for real personal comfort.

The London show revealed the fact that the British manufacturers of this type of vehicle have made decided improvements toward providing additional conveniences, if not luxuries, in motor bus travel. The most prominent feature in this respect was a limousine coach recently built by the Associated Equipment Company for the British Ex-Officers Travel Association. It contains a sitting room and a smoking room, with armchair seats upholstered in antique polished walnut. There are two tables with standard electric lamps, while the electrical equipment also includes twelve other electric lamps fitted into a ceiling of shell-fan tracery. The drop windows are covered by spring blinds, and the doors are fastened with safety locks of the type used for railway carriages. The vehicle, which is intended for long-distance runs, is equipped with a 36-horsepower engine and pneumatic tires, and the roof is constructed to carry a ton of luggage.

Another vehicle which recently completed a 1,405-mile tour in thirteen and a half days was shown. It had soft cushioned seats for twenty passengers, with very broad springs. Another saloon omnibus to carry twenty-nine passengers was exhibited.

The "Silent Room" Test

An innovation in testing motors has been developed in the Briscoe factories at Jackson. It is the "silent room" test. Into this room, designed much after the manner of the chambers used in phonograph factories for the creation of records, absolutely protected against outside sounds, the motors are brought for a special test.

The "silent room" testers are especially selected for this work and trained to the task by familiarity with every operation in the building of the motor. It is in addition to test on block and on the road.

The motors after assembly are put on block and subjected to final adjustment under variable loads and speeds. From the block test they are moved into the "silent room" and finally, they are tested in a car on the road in actual performance.

Auto Export Figures from England and Italy

The oustanding feature of the automotive export statistics of England for the first eight months of 1921 and of Italy for four months is that England is not self-sufficient, while Italy is. England has imported more automotive vehicles than she has exported. Italy, on the other hand, shows a diminishing number of imports and a comparatively slight decrease in exports as compared with Great Britain and the United States. For the eight months' period England has imported 6,420 cars, including chassis, and 2,064 trucks, and has exported 2,242 cars and 560 trucks, and re-exported cars to the number of 1,000 and trucks to the number of 1,143. To the imports of England, Italy has contributed a greater number than the United States. In four months 967 automotive vehicles were imported from Italy, while in the eight months' period but 155 trucks and 273 cars were imported from the United States.

Italy in four months has imported but 131 vehicles and exported 4,067. Her best customer has been Great Britain, who during that period took 967 vehicles; Switzerland is second, with 431; Spain third, with 404; Belgium fourth, with 249; France fifth, with 231; Australasia sixth, with 220; British India and Ceylon seventh, with 214; Argentina eight, with 188; and the United States ninth, with 95.

Italy's exports to India, Australia, and Argentina is a subject of considerable interest to American exporters. These are markets from which competition was feared from England and Germany, the former in the first two countries and Germany in Argentina. Great Britain shipped 378 complete cars to India and 103 to New Zealand during the eight months of this year. No separate division has been made for Australia proper, this being included in "other countries" classification. In view of the fact that Australian regulations limit the number of bodies which may be imported, it is quite possible that a great number of the 782 chassis for motor cars which were sent to "other countries" were shipped to Australia. Commercial vehicles to the number of 136 were sent by Great Britain to British India and 19 to New Zealand. Figures from Germany are not yet available, but known information from reliable sources does not lay stress upon German competition in Argentina. Compared with Gerat Britain's exports to the countries named, the United States makes a very favorable showing. To British India during the eight months' period, 412 cars and 178 trucks were shipped from the United States. To Australasia 1,980 cars and 689 trucks were exported.

During the month of August, England imported 992 cars and chassis and 40 trucks; her exports were 161 cars and chassis and 60 trucks, and her re-exports 67 cars and 3 trucks. From Italy during the month were imported 315 vehicles, and from the United States 49 trucks and 37 cars.

The latest statistics from Italy show that during the month of April there were exported from that country 893 automotive vehicles, valued at 27,026,752 lire, of which practically one-third went to England. Next in importance were Switzerland and Australasia, with 89 and 82, respectively. In South American markets, 57 were sent to Argentina and 20 to Brazil. Only 20 were sent to the United States. March shipments to Great Britain were 198; to Switzerland, 76; Australasia, 33; Argentina, 48; Brazil, 16; and the United States, 11. Decreases are noted in France, which took but 35 during the month of April as against 101 in March; Belgium with 20, as compared with 49 in the previous month; Switzerland 46, as compared with 85; India 4, as compared with 34; and Egypt 3, as compared with 34. The imports into Italy amount to but 30, of which 10 came from Austria, 6 from France, 8 from Germany, 2 from the United States, and 4 from other countries. The value of the imports into Italy for April was 680,037 lire, as compared with 2,369,715 for the corresponding month of 1920. The number of vehicles imported in April, 1920, was 146.

Market for Auto Accessories in China

Owing to the fact that probably 90 percent of the motor cars in China are driven by chauffeurs and not by owners, there is but a small market for labor-saving devices, such as high-grade tire pumps, lubrication devices, tire irons, jacks, and tools. The greatest promise lies in the inclination of the Chinese car owner toward luxury and ostentation, which involves a demand for all sorts of electrical appliances, particularly step, dome, and inside corner lights with fancy globes imitating cut glass, and for electric horns and radiator ornaments. The Chinese are very fond of electricity, and this, together with the carelessness of chauffeurs, means the use of a considerable number of lamps and their frequent breakage.

The radiator decorations in vogue are those of handsome design, with nickel-plated, bronze, or silver-plated finish. Nickel plate is preferred to polished brass. The grotesque figures sometimes found on radiators of American cars are not admired by the Chinese.

The Chinese like electric horns, and the larger and louder they are the better. Hand borns are fairly popular. Traffic conditions in the city streets are most difficult, and the Chinese pedestrian is one of the most carefree individuals to be found anywhere. Therefore, the frequent use of horns is absolutely necessary.

Chinese chauffeurs and automobile mechanics seem to ruin spark plugs more readily than any other part of the machine. Points and porcelains have a very short life with them, and plugs must be renewed constantly.

The increasing manufacture of motor-car bodies in China is extending the sale of such fittings and accessories as upholstery materials, beadings, window tassels, and carpets, all of which must match exactly in color; also such hardware as hinges, locks, brass and aluminum

Such luxuries as cigarette and cigar boxes, vases, vanity cases, and electric cigar lighters are very popular with the Chinese.

The market for such accessories as those mentioned is increased by the preference of the Chinese for closed cars. moldings, window screens and glass, springs, etc.

John Boyd Dunlop Dies

A dispatch from Dublin says that John Boyd Dunlop, known as the inventor of the pneumatic tire, died there at the age of 81 years. His invention, first introduced in 1888, made bicycling popular and was a forerunner of passenger automobiling. Dunlop, who was a veterinary surgeon, was led to develop the pneumatic tire through his devotion to his invalid mother who was compelled to use a wheeled chair. He hit upon the use of inflated rubber tubes around the wheels of his mother's chair to make it more comfortable for her.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO

Heptagon Building, 153 Waverly Place, New York City

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXII October, 1921 No. 7

Car Prices Still Declining

FOLLOWING a considerable number of reductions in the last week of September, which were effective Oct. 1st, the middle of October saw a considerable flurry in the makes which are grouped between $1,000 and $1,500. First the new Grant Special was announced at $1,285, then the Nash Four was cut to $1,045 (and $1,025 for the roadster), following which the Essex was reduced to $1,195. The next move was that of the Dixie Flyer to $1,345, and the latest in this group is the Hupmobile, now cut to $1,250. With Allen, Elcar, Velie, Studebaker, Oldsmobile, Cleveland, and the new Earl all under $1,300 and most of them under $1,200, it looks as though the greatest competition of next year is going to be right in this group.

Incidentally, the greatest sensation was caused by the $625 Packard cut to $2,350, which automatically brings it into a lower class than it has ever been in before. The general tendency toward further reductions is noted in the 15 percent cut in Miller and Mason tires, which it is intimated is to be followed by a general scaling down of tire prices.

It would seem that the best interests of the industry would be served by the manufacturers getting together and all making their reductions at one time, and then standing united on the platform that this was the bottom. As it is, each new cut brings a small and short spurt of business for the maker concerned, then business for all falls off, the public apparently waiting for further cuts to take place, all around. In short every additional cut announced unsettles business still more.

And yet, according to all appearances, more manufacturers are figuring on making a cut than was the case a month ago, and the near approach of show time, always a good time for new or startling announcements, would seem to afford some justification for those still to come. It is to be hoped however that all of them will be out of the way long before the spring selling season of 1922.

Fuel Consumption and the Future

EVERY thoughtful-minded person interested in the automotive industry must have noted the record consumption of gasoline (so-called) in August. In that month, a total of 503,000,000 gallons was used, and this exceeded production to such an extent that the quantity in storage was reduced by 116,000,000 gallons and now amount to but 568,000,000 gallons. That is, if the August rate were to continue the entire storage reserve would be used up in less than 5 months, in addition to the total production for those months. This, too, was in the face of a daily production which created a new record, and exceeded the 1920 daily average production by 581,000 gallons.

The very bad situation which these figures reveal gives point to any data or information on the other possible sources of motor fuel, for motor vehicle construction is continuing, and the number of vehicles in use is being increased by approximately a million this year, each of which will consume not less than 400 gallons a year, so the total increment for 1921 will be about 400,000,000 gallons a year or an average of about 1,100,000 a day.

In this connection, attention is directed to the article outlining the inherent possibilities of the Western oil shales, which will be found elsewhere in this issue. It should be pointed out, however, that two difficulties exist in connection with the shale oils. The first is that there is no present commercial production, which means that we are not progressing regularly and continuously in our knowledge of how to extract and use these oils. And the second is that a large production of oil from the shales calls for a big and expensive plant, more expensive than a petroleum outfit. Incidentally, it must be remembered that any oil produced must be marketed through the present regular and actively functioning distributing systems. When analyzed this means that the shale oils, however produced, must be marketed through the oil companies which control the distributing systems. Since such distribution would conflict with their own oil well and refinery production it means, to go farther back, that the large oil companies must enter actively into the shale oil production else it will be slow to amount to much.

The Car the Public Wants

IT IS interesting to note that compiled figures on the new cars put into use in ten counties surrounding New York City in the first nine months show that ten times as many of these fall in the "less than $2,500" class as are found in the "above $2,500" class. The exact figures are 35,755 of the former and 3,546 of the latter.

This shows plainly what the 1921 buyers have selected, and seems a very fair indication of the present and future demand for cars. A compilation of the 1918 cars, covering the entire country showed 95 percent in the "less than $2,500" class, but of these 46.8 percent were under $500. It would seem then that while the very lowest priced class has been holding up in total number of sales, the slightly higher priced makes have been increasing more rapidly in percentage of the total sales. This would seem to indicate a slight change in the public tastes for a little bit better car.

New Earl Car a High Grade Medium Sized Machine

Clarence A. Earl's New Model 40 Larger and More Elaborately Equipped Than Previous Briscoe Models—Long, Low, Powerful, Easy Riding Chassis Includes Some Novel Ideas.

IN the announcement of the new model Earl car we have an improvement on the Briscoe model 34, in many respects and almost uniformly a bigger, better and more powerful car. This was freely predicted when Clarence A. Earl, formerly executive vice president of the Willys-Overland Co., took hold of the Briscoe plant at Jackson, Mich., in a similar capacity.

The new Earl, which is now being marketed by Earl Motors, Inc., the successor to the Briscoe Corp., has a longer wheelbase, 112 in., a larger and more powerful motor, 3 7/16 x 5 1/4 rating at 18.9 but claimed to develop 37.5 h.p., and to go with these most desirable attributes, is very much improved in appearance, and carries the complete finish and equipment of a higher-priced car. While the price is slightly greater than that of the Briscoe, $1,285, compared with $1,085, it represents so much more value that it may be considered as a lower priced machine.

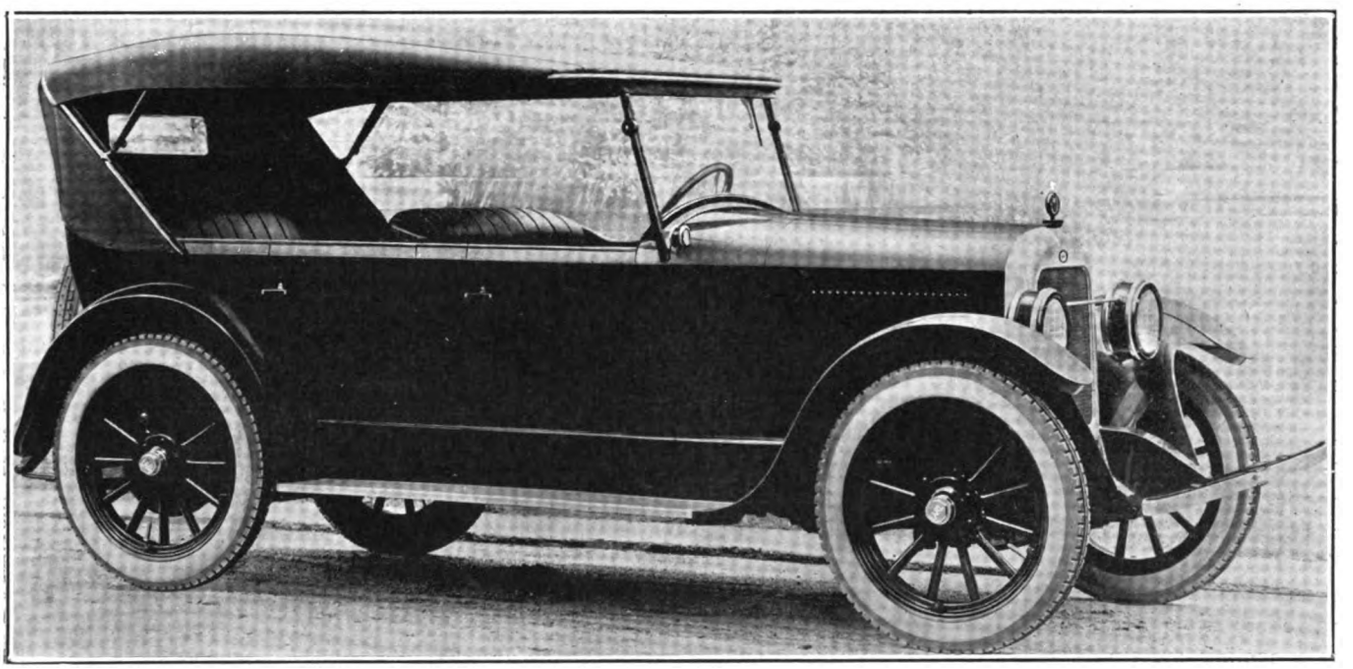

Fig. 1. The side view of the new Earl five-passenger touring model is fashionably long and low.

Much attention has been paid to body design and finish, as well as to selection and application of the equipment. The result is, as the illustrations herewith show plainly, a very superior appearing car, characterized by a long, low, up-to-date appearance.

As mention has been made of the Briscoe model, it is but fair to state that this is to be continued on a large production basis, and dealers are assured of all the cars they can handle of either model. Production has been started on the new "40," and deliveries are now being made.

Taking up the mechanical details, the engine in the new Earl model is a four-cylinder unit of the L-head type, with a removable cylinder head. The bore is 3 7/16 in. and the stroke 5 1/4, giving it an S. A. E. horsepower rating of 18 9/10 h.p., but the actual developed horsepower of the Earl motor at 2,400 r.p.m. is 37½. The unusually heavy crankshaft, which is in dynamic balance, is supported in three bronze-backed, babbitt-lined bearings. The crankshaft thrust is taken up on a center main bearing. The timing gears are of the spiral type, 1 in. wide, and while the crankshaft and generator gears are made of steel, the camshaft gear has fabroil teeth with a cast iron center, to insure quiet gear action. The compression ratio is 23 percent. The lubrication is of the low-pressure force-feed and splash type. The oil is forced through a plunger pump, operated by the camshaft, directly to the oil pockets over the three main bearings and connecting rod troughs, and the connecting rods themselves, as well as the cylinders, camshaft bearings, cams, and valves are lubricated by splash. The pressure oil gauge on the dash indicates a working pressure from 2 to 4 lbs. The carburetor is a 1 in. Scoe, with a variable venturi. The venturi opening in this carburetor adusts itself automatically to the load requirements of the motor, thereby maintaining a constant air velocity at all motor speeds. This feature makes it very flexible and economical. The two-unit Auto-lite starting and lighting system is used in connection with Connecticut battery ignition. A Borg and Beck 10-in. dry plate clutch connects the engine with the transmission, which is a unit with the motor. The whole unit power plant is supported in four point flexible suspension, which holds the motor rigid against the torque reaction, but allows the frame to twist. The transmission is of the three-speed reverse sliding gear type, with all gears and

shafts made of chrome alloy steel; the main shaft is mounted on large ball bearings. The hand brake is mounted on the rear end of the transmission and is of the external contracting band type.

The power line is straight, which gives the two flexible disc universal joints a maximum angularity of 5 deg. A feature which keeps the tubular propeller shafts concentric with the transmission and the rear axle shafts at all times is a special universal ball centering device which allows fore and aft movement of the rear axle, but no eccentric movement of the propeller shaft. This device not only removes all whipping strains from the transmission and drive pinion bearings, but the universal joint discs only have to transmit the motor torque and do not have to keep the propeller shaft central.

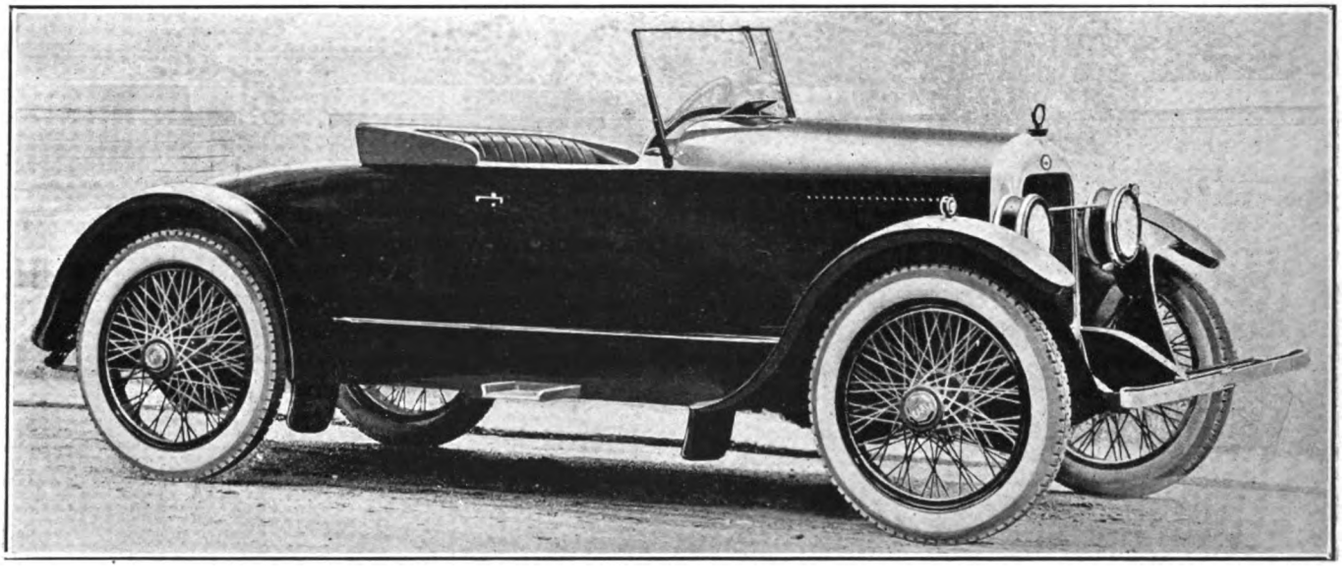

Fig. 3. Snappy, sporting lines characterize the new Earl roadster. This new model is completely equipped.

The cooling is of the thermo syphone type. A large capacity siz-zag tube radiator is used with 2-in. hose connection. The water jacket in the cylinders is brought below the bottom position of the piston, and all around the valve seats. The capacity of this cooling system is 5 gal. The location of the radiator, relative to the motor, is such that the combustion chamber is just on a level with the radiator. This arrangement keeps the hot water in the top tank of the radiator and the upper half of the radiator core, and the cooler water in the motor.

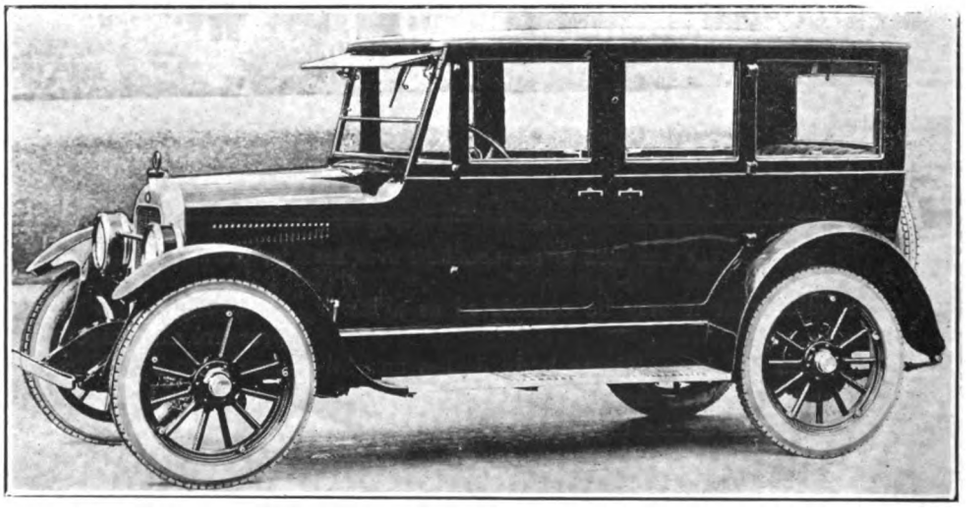

Fig. 2. The five-passenger Earl sedan is of imposing appearance and has splendid riding qualities.

The rear axle is of the semi-floating type, with differential and drive gears of nickel-alloy steel, and having a standard gear ratio of 4.66 to 1. Hyatt bearings are used in the differential and rear wheels, and New Departure radial and thrust bearings in the drive pinion assembly. All moving parts such as gears and bearings can be readily adjusted for wear without taking axle apart.

Special attention has been paid to this item by the designing engineers to provide for easy adjustment, accessible location of all parts which require attention by the owner at certain intervals. The Alemite pressure system is used throughout for chassis lubrication, Fig. 6.

The steering gear is of the worm and gear type, mounted on ball bearings and provided with means for easy adjustment and librication. Spark and throttle levers are mounted above the steering wheel, with horn button in the center of the wheel. Side, fore, and aft-linkage from steering gear to front axle is used.

Other distinguishing features are: 32 x 4 non-skid cord tires all around; rear gasoline tank with vacuum tank mounted on dash; fenders of full crown type, 10 in. wide; artillery type wood wheels, and quick demountable rims for straight side tires; center control, with long gear shift lever and emergency brake located to give every entrance to and exit from the driver's seat. The emergency brake is external contracting, and mounted on rear of transmission, while the service brake is also external contracting, 2 in. wide, and with brake drums 14 in. in diameter mounted on the rear wheels.

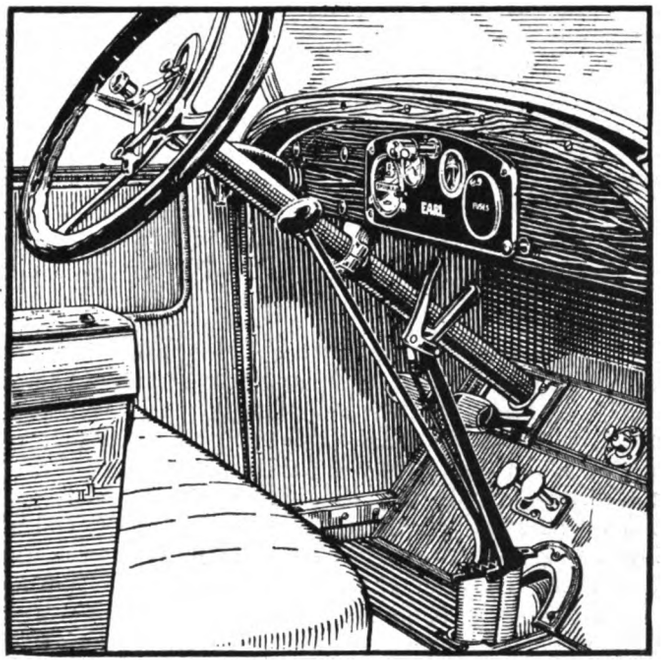

Fig. 4. Driving compartment, showing details of the control units and driver's conveniences.

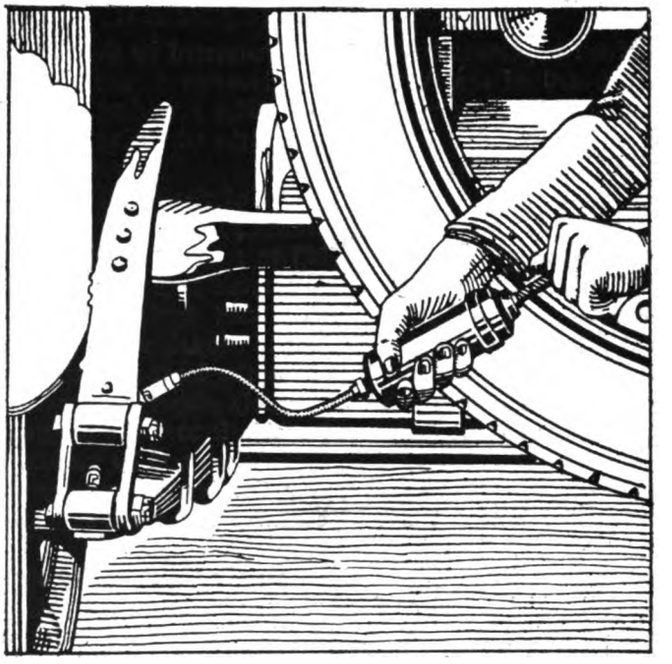

Fig. 5. Detail of the ignition switch at the driver's left. This has four positions.

Standard colors of open cars are: lake green with black chassis and fenders; and on the closed cars ultra-marine blue body, black top and black chassis and fenders.

The touring car, Fig. 1, has a five-passenger full-bevel streamline body, trimmed in black genuine leather—dull finish, and the side top rails, steering wheel rim, instrument board and cowl bar are solid American black walnut—natural grain finish and highly polished. The fuse box, oil pressure gauge, ammeter, instrument lamp and speedometer are all neatly mounted in a cluster upon a dull black enameled plate on the instrument board. The windshield is of the new one-piece ventilating type—glass 38 in. wide, and is absolutely leak proof in rainy weather. Fitting over the cowl immediately under the windshield is a molded rubber weather strip which makes an adequate rain tight joint. The top on the open cars is a low clear vision top with french bevel plate glass rear window, gypsy curtains and side curtains which open with the doors.

The seats are txeremely low to the ground, and still the normal height from the floor boards. This is possible because the floor boards are dropped below the top of frame.

An interesting feature which is found on all the models, is the design of the ignition switch, Fig. 4 and 5. It is mounted on the switchboard at the left of the steering column in a separate case within finger reach from the steering wheel. This unique position makes it possible for the driver to control all the lights on the car with his left hand, leaving his right hand to handle the steering wheel and center control. The floor boards and the toe boards are neatly finished in linoleum and bound with aluminum. Polished aluminum floor plates and scuff plates, and the liberal use of nickel plate throughout the car adds a distinguished touch. All models are equipped with a windshield wiper, complete set of tools, large honeycomb radiator nickeled and polished, drum type head lamps, and running boards. The touring car is also equipped with drum type side lights for parking. A rear view nickeled mirror above the windshield, and adjustable sun visor, and car heater are included in the equipment for the closed models.

The sedan, Fig. 3, and brougham are trimmed in high grade all-wool broadcloth, and have comfortably deep cushions with the Marshall type springs. The door windows are operated by a new crank type regulator, and all interior hardware is oxidized silver finished in a neat blue enameled design.

The road weight of the touring car without passengers is 2,550 lbs., and of the sedan 2,800 lbs.

The man who points out your faults may be a true friend—but you feel like kicking him just the same.

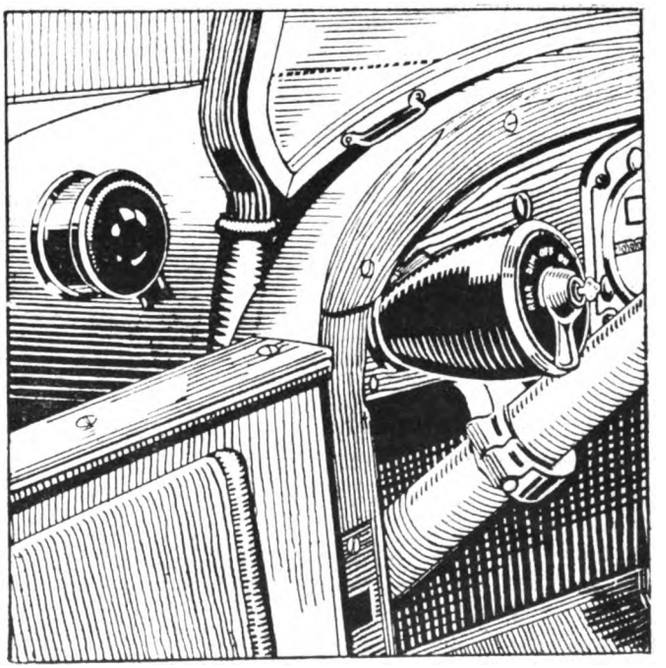

Fig. 6. This detail of the rear end shows the Alemite system of chassis lubrication used on Earl cars, and other parts.

Urge Passage of Lampert Bill

Much important business was transacted by the executive board of the American Engineering Council at its Washington meeting, Sept. 30. The presiding officers were Calvert W. Townley and J. Parke Channing of New York, vice presidents.

The council adopted the report of the committee on patents, headed by Edwin J. Prindle of New York, urging the passage of the Lampert bill to remedy conditions in the Patent Office, which, the committee asserted, were menacing the nation's industrial and agricultural welfare. A resolution approved by the council expressed the conviction that the bill "provides the least increases in force and salaries which can possibly stop the retrogression of the Patent Office and enable it to make progress toward recovering an efficient condition, and by increases in the fees for patents, supplies the funds necessary to enable the Patent Office to continue to be self-supporting.

The committee opposed the passage of the Stanley senate bill which provides for an amendment to the patent act, requiring that patents to aliens be granted with a condition that unless such patents be worked in this country within two years after the granting of the patents, the government may grant licenses under them.

Wages in German Motor-Car Building Trades

A strike for higher wages in the German automobile building trades in February and March, 1921, resulted in pay increases for both unskilled and skilled workmen.

The following wage schedule, furnished by the Schebera Aktien Gesellschaft, motor car body builders of Berlin-Tempelhof, presents, for practical purposes, the approximate current wages being paid in the automobile building trades. Unskilled labor in 1913 received 20 pfennigs per hour; before the strike it received 5 marks per hour, and now (July, 1921) it receives 6.40 marks per hour. The apprentice class of labor received in 1913 but 25 pfennigs per hour; before the strike 6 marks, and now 6.80 marks per hour.

The skilled workman before the war, 30 pfennigs per hour; before the strike, 7 marks per hour, and now, 7.80 marks per hour, with the provision that in piecework he may earn up to 10 marks per hours but no more. The first-class workman, "Vorarbeiter," receives between 8 and 9 marks an hour, while the foreman, or so-called "Meister," gets but 8 marks an hour. The working day is eight hours.

Motor Vehicles in the Bahamas

There are 191 motor vehicles in the Bahama Islands, of which 135 are automobiles, 49 are trucks, and 7 are motorcycles, all of American manufacture. The annual addition is about 6 automobiles and 12 trucks, and no effort can substantially increase these figures. Of the total population of 56,000, some 40,000 live in isolated islands, almost roadless, where there is neither money to buy nor roads to carry self-propelled vehicles.

The island of New Providence, with a coast road of less than 50 miles, contains the only town of importance in the archipelago—Nassau, with a population of 15 000. Automobiles are not stocked in Nassau but are ordered direct from the American manufacturer by the buyer or purchased in New York or in Miami, Fla. One company is represented by a local agent under special conditions, but limited prospects do not encourage exporters to seek agents nor Bahamas merchants to ask for agencies.

The duty on cars, trucks, and spare parts is 10 percent ad valorem. There is an annual registration fee of £5 for pleasure vehicles and of £1 for commercial trucks. The fee for a license to drive a truck or car is £1 per annum. There is no duty on catalogues or on printed advertising matter and packing should be as for a transatlantic or transcontinental shipment.

Friction Drive Appears Again

The friction drive is again receiving attention after a long period or more or less total abandonment. At least one new make of car has lately made it appearance on the American market, in which an improved form of friction drive is employed with what are claimed to be improtant advantages over the usual gear drive. It will be interesting to note how this car thrives in everyday use. One thing is certain, the friction drive is excellent for small, light cars. One car making use of that form of drive made an enviable record for itself while it was being manufactured. Cars of that same make are still in existence, and their performance and low upkeep costs are truly remarkable. However, with the demand for larger and heavier cars the car in question gave way to other makes which had more to offer in the way of appearance and comfort at the same or less cost.

States Get Motor Cars

Practically all of the surplus motor vehicles turned over by the War Department to the Department of Agriculture for distribution among the various states for road-building purposes have been distributed through the Bureau of Public Roads. Up to July 1, last, a total of 22,577 motor vehicles had been distributed. The greatest part of the vehicles are trucks, being part of the war material originally intended for use in France and distributed under the Wadsworth-Kahn bill, the sole condition attached to the distribution being that they should be used only for road-building purposes.

Of the 22,577 vehicles allotted up to July 1, trucks comprised 21,124 and passenger cars 3,229.

Good Field for Ingenious Mechanic

The heat of the engine which generally comes through the slots in the footboard of the average automobile is something which might well be remedied. In fact, it seems that a double wall, with a live air space between, could be placed between the engine and the front seat of the usual automobile, thus providing some protection against the excessive heat during summer driving. Furthermore, the usual pedal controls could be provided with some form of shields which would serve to stop the openings in the slots yet not interfere with the operation of the pedals. This phase of the automobile has undoubtedly been left in its original state, yet it offers a good field for the efforts of the ingenious mechanic.

The cost records of a number of paper companies in recent carefully checked tests show that the use of motor vehicles cuts the cost of log hauling as much as 70 percent compared with horses.

Consolidating Rural School Through Motor Trucks--II

Further Advantages of Consolidation, with Details of Costs, Transportation Methods and Equipment and Other Items in Successful Instances

Continued from Page 13, September issue

REGARDLESS of the advantages which can be cited for the school consolidation plan, the average country taxpayer is likely to ask first of all, will consolidation cost more in taxes than the single room school? It is wise then to state at the outset, that it will cost more measured in dollars and cents, but if the consolidated school simply replaced eight or ten one-room schools and nothing else, there would be no real reason for changing, since the change costs more. Consequently in any consideration of the costs, which is perhaps the first step toward consolidation, the benefits must be considered primarily.

The consolidated school calls for an expenditure of more money, but the money buys better things; it calls for enlarged courses of study, longer terms, better equipment and buildings, trained teachers at higher salaries, a high shhool course in addition to the elementary work, transportation, a competent principal as a community leader, larger school grounds for play and experimentation in agriculture, and numerous community projects centered about the school. Who would attempt to place a monetary value upon all these things and their worth to the community?

Fig. 9. Beautiful consolidated school at Okabena, Minn., made possible largely by motor busses.

In comparing the cost of a consolidated school system with a one-room system, per capita cost is a more accurate method of comparison that total cost. In Preble county, Ohio, at the Monroe township consolidated school the average annual cost for both tuition and transportation for each child in the elementary school was $37.62 in 1919. In the one-room school, which is in Washington township, where the enrollment was 11, the average annual cost per pupil for tuition was $50.90.

Another fact to be kept in mind is that attendance of children in the consolidated school is much better and more regular. In Somers township, Preble county, Ohio, the average daily attendance was 81 percent for the last year under the one-room system; the next year under the consolidated system the attendance was 92 percent.

The consolidated schools are maintained approximately 20 to 40 days longer during the year than the one-room school, and another fact to be considered is that boys and girls remain in school longer. In most of our consolidated schools the high school enrollment has more than doubled. In Preble county, Ohio, in the last four years of 80 pupils who have graduated from the eighth grade of the Washington Subdistrict No. 10, a non-consolidated school, only 33 entered high school. In a nearby consolidated district, of 60 pupils who graduated from the eighth grade school in the past four years, 55 entered high school, or 91 percent as compared with 41 percent in the Washington district.

It is a known fact, also, that farm land values rise immediately after consolidation. In Iowa recently 385 farmers who live in a consolidated school district were asked what effect consolidation had had on the value of their land. Of this number 280 reported that it had brought about an increase, 99 reported that it had had no effect, and six reported a decrease. In the Sargent Consolidated School district in Colorado many farmers have estimated that consolidation has added $25.00 per acre to their land.

If it were possible to place a monetary value upon all these elements of greater worth, the cost of schooling per pupil per day in actual attendance in the consolidated school would be much less than the cost per pupil per day of actual attendance in the former district school.

Money that is spent for education is an investment in the lives of boys and girls. More money is being invested by farmers in the sowing of grain so that bigger harvests may be reaped, and more money is being spent for the better housing, feeding and breeding of stock that larger returns may be obtained. Is there, therefore, any good cause why they should not put more money into better schools for their children, so that greater returns may be attained in greater efficiency and happiness?

Transportation the Biggest Factor

In at least 44 states today authority is given to school officers by the state legislature to expend public funds for the transportation of children to schools, provided the children live beyond a reasonable walking distance. It is necessary, of course, to have such authorization before the large consolidated districts can be established. It is impossible to say just how large a consolidation should be, since so many different factors enter into the determination, such as population, land values, kind of transportation to be used (motor or horse), condition of

Slightly abstracted from Firestone Ship by Truck bulletin No. 6, entitled Consolidated Rural Schools and the Motor Truck. Cuts kindly loaned by Firestone bureau.

roads, topography of the country, and standard of school desired. Of the above factors, the kind of conveyance to be employed to transport the children is one of the most important.

If auto transportation is feasible throughout the year, the district may be very much larger than if it had to depend upon the team haul. In the latter case a district of 20 to 30 square miles has been found to be the most desirable. To exceed 30 square miles usually produces some rather difficult problems for horse transportation.

It is absolutely necessary to have children enough and a large enough valuation of property to support the kind of school desired, without excessive tax. Under favorable conditions, therefore, it is advisable to establish consolidations as large as possible. The people of each locality must determine for themselves what size of consolidation will be the most economic.

Because the consolidated school to which children are transported in public conveyances cannot be satisfactory unless transportation itself is satisfactory, this factor is of great importance. Transportation must be safe, rapid, comfortable and in charge of competent drivers of high character. If it has these qualities there will be very little trouble resulting from it. In schools where transportation has not given satisfaction the difficulty can often be traced either to the driver or the form of conveyance, and in either case the trouble can usually be remedied quite easily. Transportation has been universally satisfactory wherever it has been properly handled.

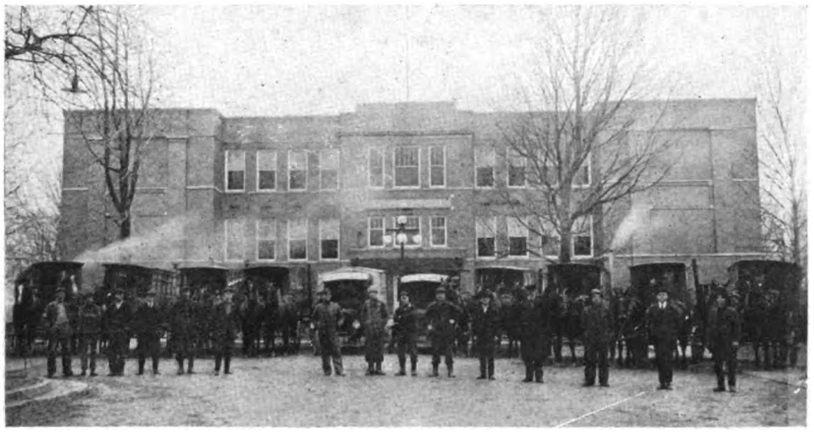

Fig. 10. Two motor busses bring 42, and nine horses 149 children to this Wayne township consolidated school at Waynetown, Ind.

Some Transportation Essentials

Every superintendent of a consolidated school should be willing to study this question thoroughly and give it a good portion of his time and attention. The superintendent of one of the most successful examples devotes about half of his time studying and supervising transportation. Too many superintendents are prone to allow the system to run itself after it is once started. If the superintendent interests himself in it, it will not be long before the children and parents are doing likewise. In some places the farmers get out early in the morning to break through the snowdrifts so that the school bus can run on schedule time, while in others the farmers expect the school authorities to run the whole system, and complain if it isn't perfect.

Bus routes should be so planned as to give the greatest service to the largest number without working a hardship to anyone. Rigid rules should be made to guard against any tendency toward laxity on the part of the drivers or children. Great care must be taken in the selection of drivers who should be competent, trustworthy, and command the respect of the children. In many places boys are not allowed to drive, although if selected carefully, they are usually satisfactory. It is hard to get drivers a fair price and competent boy drivers would solve the difficulty. The superintendent must be sure that the boy is dependable before he is allowed to take a route. Any driver that is found to be unreliable should be immediately dismissed.

Drivers should make a detailed report daily on a suitable card so that the superintendent may know at all times what is happening.

A few states, such as Minnesota, have wisely legislated some of the essential rules into the consolidation laws. The busses should follow a definite route and run on schedule, leaving fixed points at set times. They should travel along the public roads and not up to the farm houses. Two long trips per bus are not desirable, even with the motor bus, since it brings so many to school too early. Some school districts have met this condition by routing the district so that each motor bus daily covers a long and a short route.

The plan of allowing parents or guardians to provide transportation for their children should not be advocated under any circumstances. Although it is less drain on the school funds, the total expended by the school patrons is much greater. If children drive their own rigs, the horses are not available for other work. Neither does this plan assure the regular attendance prevalent where public transportation is supplied. Parents should not lose sight of the great moral advantage that there is to public transportation, where their children are always in the care of a responsible driver. Transportation is as much a part of the school system as any other phase. Therefore, it should be in complete control of the school authorities at all times.

The following tables give analyses of the transportation methods in five different purposely selected so as to show what is accomplished in widely separated parts of the country.

McKinley School, White R. Township, Randolph Co., Ind.

Kind of Conveyance	Wage per day	Length, route	Children	Time
Auto Bus	$3.00	11 miles 8 miles	27	7:00—7:45 8:10—8:35
Auto Bus	3.00	11 miles 9 miles	28 31	7:00—7:45 8:00—8:35
Auto Bus	3.00	11 miles 7½ miles	27 27	7:00—7:45 8:00—8:30
Auto Bus	3.00	10 miles 6 miles	25 29	7:00—7:50 8:15—8:30
Auto Bus	3.00	12 miles 6 miles	25 18	7:05—8:00 8:15—8:30
Ordinary Auto	2.50	6½ miles	6	8:00—8:22
Ordinary Auto	2.50	3½ miles	6	8:00—8:20
Ordinary Auto	2.00	3½ miles	8	8:10—8:25
Private Rig	1.50	5 miles	5	

(School opens at 8:45. The auto busses are owned and operated by the school.)

Jackson Township Central School, Preble Co., O.

Kind of Conveyance	Wage per day	Pupils hauled per route	Length, route	Average time to drive	Character of roads	Time first child gets into bus
Auto Bus	$12.00	30	9.5 mi.	38 min.	fair	7:00 A.M.
		25	2.5 mi.	25 min.	good	7:55 A.M.
Auto Bus	12.00	28	10.7 mi.	40 min.	fair	6:55 A.M.
		30	8.2 mi.	35 min.	fair	7:50 A.M.
Auto Bus	11.00	39	9.2 mi.	50 min.	good	7:38 A.M.
Auto Bus	12.00	30	15.9 mi.	50 min.	fair	7:00 A.M.
Wagon	7.00	28	9 mi.	75 min.	poor	7.00 A.M.

(The auto busses are owned by the drivers who meet all operating expenses. Wagon but not horses owned by township.)

Sargent Consolidated School, Rio Grande Co., Col.

Kind of Conveyance	Wage	Miles Bus Travels	Children	Time
1. Auto Bus		13		
2. Auto Bus		15		
3. Auto Bus		14		No child
4. Auto Bus	Drivers	17	Average	enters bus
5. Auto Bus	get	19	number	before 7:55.
6. Auto Bus	$1.25	20	per	School
7. Auto Bus	per day	22	bus, 34	opens at
8. Auto Bus		15		9:15
9. Auto Bus		12		
10. Auto Bus		13		

(Drivers are 8 teachers and 2 high school boys. School owns and operates auto busses, has garage on school grounds and pays an auto mechanic $150.00 per month to keep busses in good running condition.)

Malden Consolidated School, Kanawha Co., W. Va.

Kind of Conveyance	Wage	Length, route	Children	Time of Starting each route
Auto Bus	$3.75	4 miles	35	7:45
	per day	3 miles	30	8:00
		2 miles	20	8:20
		7 miles	35	8:45
		2 miles	21	9:10

(One auto bus makes all five routes. Students begin their study and work as they arrive, and leave at night in the same way. School owns bus and pays all operating expenses.)

East Chain Consolidated School, Martin Co., Minn.

Kind of Conveyance	Wage per day	Length, route	Children	Time
1. Horse Hack	$4.50	5 miles		
2. Auto Bus	4.50	4 miles		
3. Auto Bus	4.50	4½ miles	Average	First child is
4. Auto Bus	5.00	4½ miles	23	picked up by
5. Auto Bus	5.00	4½ miles	children	horse hack at
6. Horse Hack	2.25	3 miles	to the	7:15, by motor
7. Horse Hack	5.00	5½ miles	route	bus at 8:15
8. Horse Hack	4.50	4½ miles		
9. Auto Bus	5.65	6 miles		

(School owns and operates all conveyances. Five high school boys and four farmers drive.)

The Driver and Ownership Problems

In is of major importance that the school boards control the driver situation, as well as obtain its drivers as cheaply as possible. Competitive bidding does not insure this, and the best way has generally been for the superintendent to go out and select his own drivers, then make the best possible bargains with them, individually.

The motor bus seems to be the preferred vehicle, and even townships that have used horses with good success, are planning to motorize, while those using some motors are planning to motorize the system completely. Where the law permits, the schools should own the facilities, in spite of the success of hiring complete outfits. The latter have been considered good on the ground that the drivers will take care of their own property better than they would of school property. This has not always worked out and the major tendency is toward school ownership, although each consolidated district should decide for itself.

The following are some of the outstanding advantages and arguments for public ownership:

1. Control generally goes with ownership. Sometimes the superintendent must lengthen or change routes. Driver-owners of busses are not always willing to meet these adjustments.

2. It is sometimes very difficult to find the right kind of a driver to invest his money in a bus. If the school owns the bus it is much easier to get a good driver.

3. An incompetent driver who owns his bus cannot easily be dismissed because a successor cannot always be found who would be willing to invest his money in such an undertaking.

4. School ownership usually means better and more comfortable busses since making money is not the school's object.

5. If properly managed the cost of transportation is generally cheaper under school ownership.

6. The number of instances of breakdowns and delays is fewer under school ownership. The busses are usually kept in better repair and can be frequently and uniformly inspected.

7. Drivers can be secured more cheaply under school ownership. In the Sargent School in Colorado eight teachers and two high school boys drive the ten auto busses and receive a monthly salary of $25.00 each. This would not be possible under private ownership.

Good roads and consolidated school systems are very closely interwoven, without the former the latter cannot be successful. The next installment will take up the subject of roads and their relations to the regular operation of school busses.

Least Auto Travel Tuesday and Wednesday

If you are going on an automobile trip and want to avoid all possible traffic you should go on Tuesday or Wednesday. Such is the conclusion reached from a study of traffic census taken recently by the Bureau of Public Roads, United States Department of Agriculture, on one of the most traveled roads in the United States. If you want to go at an hour when there will be the least traffic, start between 2 and 3 o'clock in the morning.

Traffic increases in amount steadily from Wednesday to Saturday, the census shows, and then jumps into big volume on Sunday. The volume on Sunday is about twice that on Tuesday or Wednesday. On Monday there is a decided drop from the Sunday figures and on Tuesday the lowest ebb is reached.

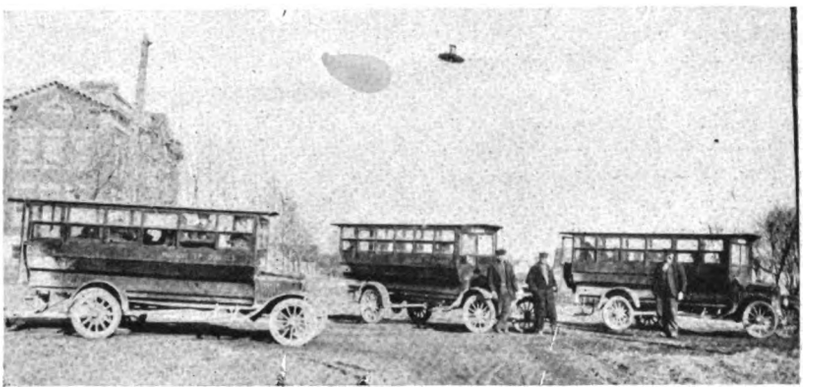

Fig. 11. Three of the five motor vehicles used at Linden, Ind., to serve a consolidated area of 30 square miles.

There is less traffic on the road between 2 and 3 o'clock in the morning than at any other time of day. From 3 o'clock to 5 there is a slight increase; then a steady climb until 11. Between 11 o'clock and 1 there is a slight drop, and then an increase again until the peak is reached between 2 and 3. After 3 o'clock traffic drops slightly until 7 when the decrease becomes more pronounced. By midnight traffic has almost reached its lowest point.

Ninety percent of the day's traffic, the census shows, rolls over the road between 7 a. m. and 9 p. m., and 52 per cent between 1 p. m. and 8 p. m.

Belgian cars are dominating the Belgian market, American-made cars being the hardest hit. Belgian cars have increased 45 per cent; French still hold their own, with an increase of about 40 per cent. The fluctuation in the market seems due to the demand for the lighter cars of French and Belgian make.

Aims and Purpose of S. A. E. Research Department

Will Confine Its Efforts to Explorational and Intensive Fundamental Research—Manager of New Department Gives His Views.

President Beecroft of the Society of Automotive Engineers, has expressed the view that within less than ten years the research department which the society established recently will be of as great magnitude and value to the industry and the country as the S. A. E. standards department which is just entering its second decade.

Dr. H. C. Dickinson, the manager of the S. A. E. research department, in an address before the Detroit section of the society at its opening session of this season, outlined the purposes, aims and possibilities of the department. He said that in general the testing of any individual device or any particular material is not included in the definition of research. On the other hand the study of methods of test as well as the deduction of general information from a systematic series of tests is properly so classed, although to be of value as research the results must be put in such form that they can be of general application.

Development research is recognized as clearly an exclusive function of the individual engineer and the industrial laboratory. By far the largest part of the work of all laboratories connected with the industry is of this nature and as such is recognized by the department as essentially confidential, whereas it is coming to be more and more generally recognized—although we regret, sometimes more as an abstraction than as a course of action—that there is much more to be gained than lost through a free interchange of all research information which is capable of general application.

The S. A. E. research department will therefore confine its efforts to explorational and intensive fundamental research. Much work of this nature which is in progress in the industrial laboratories will be of interest to the department and it is hoped that much more such work will be undertaken in the future. But with the major part of the work of these laboratories which is development work, we will not concern ourselves.

An unbelievable amount of time and effort is wasted in the trial of expedients which a more careful application of the fundamental laws of physics and chemistry would have shown at a glance were based on incorrect assumptions. This fact, as startlingly illustrated during the war when thousands of inventions of every conceivable sort were presented for consideration of the government. It is safe to say that at least 90 percent of these proposals showed such obvious and fatal errors in fundamental physical and chemical principles that they could be absolutely condemned at a glance. Of course most of them could be condemned equally on practical grounds but one's judgment as to practical possibilities is by no means so safe a guide. Many things which look impractical do actually work but so far as we know nothing works which violates the law of conservation of energy, or the second law of thermodynamics, or Newton's laws of motion, barring Einstein, or any other of a few hundred such principles.

Successful engineering research, as well as economical development work, requires men with a peculiar combination of broad fundamental knowledge and sound common sense, with the enthusiasm of the typical inventor but without his typical shortcomings.

The most common incentive for the organization and continued support of research laboratories or of any systematic research program is necessarily the commercial one. In fact this is almost the only one if we except some of the educational laboratories which have been endowed purely for the sake of the advancement of science. Thus almost every research laboratory and particularly the industrial ones present a constant conflict between these two points of view which are somewhat incompatible. The true research worker is interested in securing facts and will not be satisfied until his results are complete. Moreover every problem he undertakes presents to him numerous side-lines which are of absorbing interest. If given his own way, unless he is endowed with unusual self-control, he will either carry through his problem to a final conclusion or switch to some side-line of greater interest, according to his temperament. On the other hand, the director of the laboratory or the "man who pays the bills," unless endowed with unusual patience and foresight, will, as soon as some fact of apparent commercial value is developed, recommend dropping the research and developing something useful. A happy compromise between the two points of view is difficult to attain. But a real compromise is necessary since both viewpoints are important and neither side may be neglected.

Up to within the past few years the United States which has shown by far the greatest industrial development in automotive lines, has contributed comparatively little to the sum of automotive research. The work of British and German experimenters had to serve the needs of our own engineers even though it was entirely inadequate for our needs. In the past few years, however, there has been a general awakening to the need of research among members of the society. Its importance has been so ably presented in recent papers and discussions that it is hardly necessary to further emphasize this phase of the subject. We are now awake to the need and once awakened the United Staes will not lag behind. In fact, perhaps a warning is needed that while the possibilities of research can hardly be overestimated, the realization of these possibilities in terms of industrial results, rests with the engineers in charge of design and development. No matter how many and able the research engineers, nor how important their conclusions, these conclusions will be of value only insofar as they are embodied in successful design.

Aims of the Research Department.

In general, the object of the S. A. E. research department is to secure through concerted effort more, and more reliable, fundamental technical information for the use of the members of the society and to make this information more easily available. The distribution of information may be handled in several ways.

Fundamental research is in the last analysis almost en-

tirely a question of men rather than of equipment. Many of the most important scientific results have been obtained without laboratory equipment worthy of the name. A study of the research situation in the various laboratories leads to the conclusion that these laboratories are even now sadly undermanned, particularly with men of real ability. To establish a new laboratory could not increase the supply of first-grade research men; hence it would have to be manned at the expense of existing institutions. Thus, whatever results the new laboratory might attain would be at the expense of other institutions and the net result would probably not be increased research. It appears therefore that the department can most profitably devote its efforts to assisting existing laboratories.

The three classes of laboratories—educational, industrial, and independent—occupy altogether different positions in regard to research, and any general plan must take account of these differences. It is recognized that the prime object of the industrial laboratories, those directly connected with the various manufacturing companies, must always be development research. But in connection with these we hope there will be accomplished an ever-increasing amount of fundamental research work which can be made of general value—such work as deals with general principles rather than specific questions of design. It is a very common experience to find one laboratory undertaking a research intended to cover some problem which has been carefully covered elsewhere, but no record of which is available. It is one of the aims of the research department to secure, so far as possible, the publication or at least a record of such non-confidential general results and to act as a clearing-house of information on research problems of this character. For the most part, the various laboratories are rather well supplied with problems, but from some institutions where new facilities or new men have become available, there have come requests for suggestions as to problems or general lines of work which might be taken up to advantage. It would seem that here is a splendid opportunity for better use of the educational laboratories by the industry. The custom of farming out individual research problems has been followed to some extent but there is room for much more of it. The S. A. E. research department stands ready to offer any possible assistance in securing more co-operation of this kind.

Duplication of Research

Recently very much caustic criticism has been heard regarding duplication in all sorts of connections, including research. One might make remarks about the duplication in criticism. Research is always a matter of duplication since no physical fact is ever established except through repeated observation. Much apparent duplication is not only desirable but necessary. Nevertheless, this applies to intelligent duplication only. Not much is to be gained by having several different laboratories working on the same problem unless each knows something about what the other is doing. This latter sort of duplication should be avoided particularly among the bodies, together with the materials and parts that enter educational laboratories so far as possible. Since the results of most research are not to be had in print for months or perhaps years after the work is begun, the most promising means of preventing unnecessary repetition seems to be through some central clearing-house for work proposed and in progress. This function the S. A. E. Research Department will hope to fulfill.

General Research Program

One of the important objects of the S. A. E. research department is to assist toward the development of a more systematic program of research throughout the industry. The formulation of such a program is too much of a problem to be solved for some time to come. It must be built up little by little with the co-operation of the members of the Society of Automotive Engineers.

There are, however, two broad general problems which are brought to our attention at once by their importance and the insistent demand for immediate information. These are the fuel problem and the highway problem. A very important question is: What is the relation between endpoint or volatility of fuel and the average fuel consumption in actual service. To answer this we must know what constitutes upper limit of volatility—is it endpoint or something else? Robert E. Wilson of Massachusetts Institute of Technology has brought out something of interest here but the question is not yet answered.

The highway problem has received less attention by the automotive industry partly because its importance seems to have been less recently appreciated and partly because it does not appear at first sight so immediate a problem of the industry. It has been heretofore mainly a question of "good roads." So far as the passenger-car alone is concerned, this may be largely true. Considering, however, the broad question of the economics of highway transportation, the problem is distinctly an automotive one. It is not possible to consider only the design of a truck, for instance, that will give maximum ton-miles per dollar if it has a road to travel on, without including also the cost of the highway. So long as registration fees for passenger-cars paid for good roads, we were all reasonably content, but as soon as the highway is commercialized, so to speak, some one will be inquiring about the proper distribution of the highway bill among the different classes of traffic. Some answer to this question will have to be made. Perhaps it is a problem for the road engineer, but the automotive engineer will be very much interested in both the answer and the method of arriving at it. The nature of this answer or the relative license fees which may be based on it will be a large factor in deciding what sort of truck will be most economical for any given class of service.

Art in the Motor Car

Automobile body designers as well as private owners seeking ideas for artistic effects in custom made bodies will doubtless be interested in the exhibit portraying the various steps in the designing of the automobile body, which forms part of the industrial crafts and graphic arts exhibition opened Oct. 31 in the new building of the Art Center, 65-67 West Fifty-sixth St. The exhibition demonstrates the application of art to motor car design. Drawings first show an original sketch in pen and ink of the side elevation of the car, second an interior style, third a color card, upon which is mounted a sample of the paint, fabric, leather, headlining, and other materials in the finishing of the body, where a good idea of their harmony may be gained, and fourth, the ensemble as depicted in carefully rendered color drawings.

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are What They Are What They Are Doing

J. J. Wilson, pioneer foundryman in automobile work, has severed his connection with the General Motors Corporation and taken charge of the foundry division of the Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont. This new company will engage in making a general line of motor castings. He was with H. M. Leland in the early operations of the Cadillac foundry when it was known as the Leland-Faulkner Co., and remained with the company through its various stages until it became a part of the General Motors Corporation. Subsequently he was in charge of all General Motors foundries and developed their large new plants such as the Buick and Motor Products Co. in Saginaw.

George Shortmeier, formerly New York manager for the Madison Rubber Co. and later district manager at New York for the Sinclair Oil Co., has been placed in charge of the Bosch Magneto Corporation branch at New York, replacing O. S. Stanley. Charles L. Shedd is now manager of the Bosch branch at Detroit, taking the place of Roy Davey, who has been made manager of the manufacturing sales department at Springfield, Mass. Mr. Shedd was at one time promotion manager of the truck division of the Packard Motor Car Co. at Detroit, subsequently served as official distributor at Omaha for that company and still more recently acted as sales manager of the Republic Truck Corporation at New York.

LeRoy Kramer has been elected president of the Rochester Motors Corp., maker of the Rochester-Duesenberg engine. Kramer at one time was vice president of manufacturing for the Willys-Overland Co., retiring from this post to become president and general manager of the Van Sicklen Speedometer Co. Last April he was made vice president of the Pierce-Arrow Motor Car Co. He succeeds as president of the Rochester company C. J. Symington, who is president of the T. H. Symington Co., and who now becomes chairman of the board of the Rochester-Duesenberg organization.

William Beckman, for many years assistant to Fred S. Duesenberg and prior to that chief engineer of the Loew-Victor Engine Co. of Chicago, is now vice president in charge of engineering of the newly formed Richelieu Motor Car Corp. of Asbury Park. The company is assembling chassis in a temporary plant while the bodies are being fitted at the plant of the Fleetwood Metal Body Co. The directors of the Richelieu corporation are interlocking with those of the Rochester Motors Corp. and the car will be powered with a four-cylinder Rochester-Duesenberg engine.

J. H. McDuffee, who recently became first assistant to the head of the Cole Motor Car Co., Indianapolis, announces that Homer McKee, formerly in charge of Cole sales and advertising, has been appointed advertsiing counsel, and will handle Cole advertising through the Homer McKee Advertising Co. of Indianapolis. Simultaneously the appointment of Charles S. Crawford, formerly chief engineer, as engineering consultant, is announced by President Cole.

Wm. N. Davis has been appointed body engineer for the Cadillac Motor Car Co. Mr. Davis began his connection with Cadillac more than ten years ago and was assistant body engineer until the outbreak of the war, when he left the Cadillac for a short time to serve in connection with the manufacture of aeroplanes. After two years as engineer for another manufacturer of an 8-cylinder car in Detroit, Mr. Davis resigned to resume his former associations with Cadillac.

Richard H. Collins, formerly vice president of the General Motors Co., and president and general manager of the Cadillac Motor Car Co., Detroit, has acquired control of the Peerless Truck & Motor Corporation, Cleveland, through the purchase of about $4,500,000 in stock, and has been elected president and general manager of the Peerless corporation. H. A. Tremaine, formerly president, remains on the board of directors.

Fred J. Haynes, president, and **John Ballantyne,** treasurer, the key executives of Dodge Brothers, have just entered into an iron-clad contract with that company covering a long period of years. The announcement is intended to set at rest at once and for all time thoughts that there is the slightest chance of a change in Dodge Brothers, either in ownership or management.

D. McCall White, associate president of the Lafayette Motors Co., Indianapolis, has resigned. White feels that the corporation has reached a point in its development of the Lafayette car where his services as a designing engineer are no longer required. Management of the company will not be affected in any way and no successor to White will be appointed.

William S. Knudsen, associated with the Ford Motor Co. for the last ten years, has resigned from that organization to become general manager of the Ireland & Matthews Mfg. Co. Before joining the Ford company Knudsen served as general superintendent of the John R. Keim Mills, Inc., Buffalo.

O. W. Williams, for the past four years in charge of material and costs for the United States Motor Truck Co., Cincinnati, O., has been made purchasing agent of the company. Williams at one time was connected with the Interstate Motor Co., as auditor and service manager.

Leland F. Goodspeed, who for the past five years or more has been chief of the engineering staff of the Roamer, has resigned from the Barley Motor Car Co. to become vice president in charge of engineering of the Commonwealth Motor Co., Chicago and Joliet, Ill.

Henry Thomas Platz has resigned as chief engineer of the Alvo Co., automobile headlight division, at Ashland, O., to become engineer of design for the Gray & Davis Lamp Corp. at Amesbury, Mass. He formerly was chief engineer of the C. M. Hall Lamp Co., Detroit.

Additional Notes of Body Builders

Smith & Co., Chicago, manufacturers of automobile bodies and tops, are having a building constructed for them for a one-story factory, 50 x 125 ft., 3737-9 North Clark St., to cost $10,000.

Metropolitan Body Co., Philadelphia, has been chartered under state laws to manufacture automobile bodies. Rush H. Hartman, 4712 North Hutchinson St., is treasurer.

Canadian Gary Motor Truck Co. has secured a building on Atlantic avenue, Toronto, and will install equipment at once for the manufacture of trucks, etc.

Oakland Motor Car Co. Pontiac, Mich., has begun construction of a sawtooth manufacturing building, 240x300 ft., a subsidiary of the General Motors Corp.

Collins Carriage Co., Philadelphia, has leased the building at 158-62 North Twenty-second street for the establishment of a new body building plant.

Ford Motor Co.'s body plant at Iron Mountain, Mich., will be built by Worden-Allen Co., Chicago. Construction will start immediately.

Belgrade Wagon Works, Belgrade and Cambria Sts., Philadelphia, has filed plans for the erection of a new one-story shop.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Metropolitan Motors, Inc., Kansas City, Mo., is planning to manufacture a light weight high efficiency motor car and will shortly release contracts and orders for the first lot of about 200 cars. About 100 will be equipped with a high grade four-cylinder engine and the balance will have a six-cylinder motor. The wheel base is 122½ in and two tire sizes in cords 33x4 and 33x5, with wood, wire, or disc wheels as optional, will be standard equipment. Four body models in sedan, coupe, roadster and touring will be furnished. Price will range from $2,500 to $3,500. The company is interested in receiving quotations, blue prints, catalogues, and customary samples from parts and accessory manufacturers as well as body builders. The cars will be built in Kansas City. This is a close (Missouri) corporation and the capital stock is held by the officers of the company. The officers are: Harvey D. Taylor, president and general manager; G. H. Clevidence, vice president and secretary; Ross H. Rheem, treasurer; Robert H. Campbell, engineer and purchasing agent; A. M. Feltenstein, secretary to the president.

Rickenbacher Motor Co., Detroit, has obtained possession of the Michigan Avenue plant of the Detroit Pressed Steel Co., formerly occupied by the Disteel Wheel Corporation division of the latter company. It consists of 27½ acres, with a one-story building, with 12½ acres of floor space, and a foundation for a building with 250,000 sq. ft. of floor space. The property was originally used for shell manufacture. The Rickenbacher company expects to get into production by January, with a schedule of 200 cars a day.

Oakland Motor Car Co., Pontiac, Mich., will resume work at once on the erection of its new one and two-story plant for engine manufacture and other auotmobile construction. Foundation work was placed under way some months ago and later discontinued owing to business conditions. It will cost in excess of $2,000,000 with machinery. The duPont Engineering Co., McKerchey Building, Detroit, is engineer and contractor.

Briscoe Motor Co., Jackson, Mich., has been reorganized under the name of the Earl Motors, Inc., with Clarence A. Earl, formerly first vice-president Willys-Overland Co., Toledo, O., as president. It has arranged for a bond issue of $5,000,000, a portion of the proceeds to be used for plant enlargements and the installation of additional machinery. Production will soon commence on a new automobile, to be known as the Earl.

General Motors Corp. recently announced that the manufacture of its entire line of export models, with the exception of the Cadillac and General Motors truck, will be concentrated at the Oshawa, Ont., plant. The reason for the change is that with all export trade under one head there should result a better realization of the necessities of the business and the production of a line of cars better fitted for export trade.

Oshkosh Tractor Co., Oshkosh, Wis., has let contract for the substructure of its new machine shop and assembling plant, 150 x 500 ft., to A. Nielson & Son, Neenah, Wis. Auler & Jensen, local architects, are now asking bids for the erection of the superstructure of brick and steel, with sawtooth roof. It will cost about $275,000 and is to be ready Dec. 1. A. D. Paine is president and general manager.

Peerless Motor & Truck Co. plant, Quincy Ave., Cleveland, has been acquired by Richard Collins, former president Cadillac Motor Car Co., Detroit, and vice president General Motors Corp., for $4,500,000. Mr. Collins is now associated with W. C. Durant, president Durant Motors, Inc., 1819 Broadway, New York, and has been elected president and general manager of the Peerless company.

Motor Wheel Corp., Lansing, Mich., has announced its expansion plans for the immediate future. The oldest of the Prudden Wheel Co. buildings will be demolished to make room for a new rim unit and office space. The present hub shops of the Prudden and Auto wheel plants will be consolidated into one shop of increased capacity, for which considerable machinery has been ordered.

Kelsey Motor Co., 25 Branford Place, Newark, N. J., has purchased about 6 acres on Washington Ave., Belleville, N. J., as a site for its proposed new works for the manufacture of friction-drive automobiles and parts. Plans have been completed for the initial works and bids for construction are being asked. The Industrial Engineering Co., 30 Church St., New York, is engineer.

Martin Motor Co., Springfield, Mass., recently organized, is arranging for the establishment of a plant to manufacture small automobiles, consisting of a car made of aluminum and duralumin, weighing about 200 pounds. Charles J. Glidden is president, and Charles H. Martin, head of the Martin Rocking Fifth Wheel Co., is interested in the company.

Locomobile Co., Bridgeport, Conn., has withdrawn from its affiliation with Hare's Motors, Inc., Trenton, N. J., and in the future will operate independently its local plant. New officers include: Elmer H. Havens, president; F. R. Hickman, vice president and treasurer, and E. A. Travis, general sales manager, all of Bridgeport.

Crown Motors Corp., New York, has been incorporated with a capital of $1,000,000 under Delaware laws by John T. McGovern, M. E. Nolan and E. C. Ballantyne, New York, to manufacture automobiles and motors. The company is represented by the Delaware Registration & Incorporators' Co., Ford Building, Wilmington, Del.

Owen Magnetic Motor Car Corp., Forty-Fort, near Wilkes-Barre, Pa., manufacturer of automobiles, will be offered at a receiver's sale, Nov. 5. The plant consists of one-story buildings, fully equipped with machine tools and other machinery. Robert Penington and James P. Harris, Wilkes-Barre, are receivers.

Warner Auto Equipment Co., Benton Harbor, Mich., recently organized to manufacture shock absorbers and other automotive equipment, will carry out initial production at the plant of the National Axle Co., Benton Harbor. Later it is proposed to build a plant. Clarence T. Warner is president.

Star Truck Co., Los Angeles, has had plans prepared for a new plant on Commercial St., including a two-story structure, 42 x 90 ft., and two one-story buildings, 40 x 110 ft. and 28 x 100 ft., respectively. Construction will be placed under way at once. John J. Frauenfelder, 1116 Story bldg., is architect.

Bush Mfg. Co., airplane, tractor and truck radiators, Hartford, Conn., has bought the property of the Ellison Construction Co., occupied by the American Machine Co. on Wellington St. It comprises three acres with a 300-ft. frontage, containing a factory, storage house and other buildings.

Morand Cushion Wheel Co., Chicago, has purchased 20 acres on the northwest corner of Western Ave. and Seventy-seventh St. and contemplates the erection of a plant to cover the entire tract. No architect has been selected. Joseph Morand is president.

Coats-Steamer Automobile Co., Indianapolis, recently

organized in Delaware with capital of $5,000,000 to manufacture automobiles, is negotiating with the Chamber of Commerce, Terre Haute, Ind., for a site for the erection of a new plant. The proposed works will be about 75 x 600 ft.

Harrison Radiator Corp., Lockport, N. Y., has bought property in that city at a cost of $30,000 for an addition to its plant. The corporation is owned by General Motors and at present is operating at about 50 percent. When normal the present plant employs 1,200 men.

Stanley Welded Wheel Co., North Tonawanda, N. Y., which is erecting a plant in that city, is expecting to be operating at an early date. The company will manufacture wheels for automobiles and will employ about 200 men at the beginning of operations.

Big Four Truck Co., Sacramento, Cal., manufacturer of automobile trucks and parts, has plans under way for its new works at Richmond, Cal. The site totals about 11 acres and the main building will be 70 x 350 ft. Electric traveling cranes will be installed.

Auto Parts Co., 104 North Front St., Baltimore, recently organized with a capital of $100,000, is planning for the installation of machinery in a local building to manufacture automobile parts and other products. John and George Beck head the company.

Eagle Motor Truck Co., 6154 Bartmer avenue, St. Louis, has awarded a contract to Rodinan & Son, 6065 Clemons avenue, for the superstructure of its new one-story plant on Bartmer avenue, 50x150 ft., estimated to cost $50,000. J. P. Reis is head.

American Commercial Car Co., Detroit, Mich., manufacturer of automobile trucks, with plant at Gratiot Ave., and the Detroit Terminal railroad, has acquired a building at Knoxville, Tenn., and will remodel it for the establishment of a branch plant.

Packard Auto Radiator Co., 293 Fountain St., Providence, R. I., has filed notice of organization to manufacture automobile radiators and other metal products. Adolph H. Jodat, 74 Newman Ave., Seekonk, Mass., heads the company.

Britton Motor Axle Co. has been organized in Saginaw by William M. Britton, formerly chief engineer Republic Motor Truck Co., Alma. It is capitalized with $500,000 preferred and 30,000 shares no par value common stock.

American Bosch Magneto Corp., Springfield, Mass., has just completed the erection of its 10-story Bosch building, at 17-19-21-23 West Sixtieth St., New York, of steel, floors for its automotive electrical sales and service station.

Sinclair Militor Corp., New York, has been incorporated under Delaware laws with capital of $1,100,000 to manufacture automobiles and parts. It is represented by the United States Corporation Co., 65 Cedar street.

Canadian Gary Motor Trucks Corp. will establish a plant at Fort William, Ont., to supply the western Canada trade. It is a new subsidiary of the American company and will be incorporated for $4,500,000.

Woburn Cylinder Grinding Co., Woburn, Mass., recently organized, has established a plant on Prospect St. to specialize in general machine work, cylinder grinding for automobile and marine engines, etc.

Driggs Mfg. Co., New Haven, Conn., which was formed some time ago to build a line of passenger cars, has completed the test car and a first lot of twenty-five cars is being put through for production.

Floatless Carburetor Co., 916 Munsey Bldg., Baltimore, recently incorporated with $100,000 capital stock, is understood to be planning the establishment of a factory. R Contee Rose is interested.

Haynes Wire Wheel Works, Inc., Jackson, Mich., will commence the immediate erection of a one-story shop addition, 80 x 190 ft., estimated to cost about $25,000. Stanley Porter is manager.

Kess-Line Motors, M. C. Kessler, president, has obtained possession of the former Detroit plant of the Liberty Motors Car Co. and will manufacture the Kess-Line 8-cylinder automobile.

Duty Motor Truck Corp., 19 North Spring St., Elgin, Ill., will break ground at once for a new one-story plant, 125 x 250 ft., estimated to cost about $75,000. W. H. Reuther is president.

Parker Motor Car Co., recently incorporated with a capital stock of $10,000,000 has leased space in the plant of Caron Brothers, Longue Pointe, Montreal, for assembling cars.

Dodge Brothers, Detroit, have purchased 35 acres at Sandwich, Ont., with 350 ft. water frontage, and propose to erect an assembling plant.

Eagle Motor Truck Co., 6156 Barmer Ave., St. Louis, has just completed an addition to its factory.

Body Builders

L. C. Graves Co., a corporation of Springboro, Pa., manufacturer of commercial car and truck bodies, has purchased the plant of Moore Motor Co. at Danville, Ill., and will operate it under the name of the United Automotive Body Co., employing 500 men. The new company will be capitalized for $1,250,000. The United Automotive Body Co. of Cleveland was recently absorbed by the L. C. Graves Corp. The latter was organized in 1870 for the manufacture of horse propelled vehicles. F. O. Darling is general manager and R. M. Hawn chief engineer of the Graves Company. The former will make his headquarters here. The Cleveland office is to be closed, but branches at Detroit, Lansing, Toledo and Youngstown will be continued.

Fort Smith (Ark.) Body Co., with a capitalization of $100,000, has been formed to take over and operate the Johnston Commercial Body Co. plant. Incorporators: Ben Johnston, president; I. H. Nakdimen, secretary and treasurer, and J. B. McDonough. The plant manufactures truck bodies for all makes of automobiles.

Andrew Nelson and Christian Hansen have established a new plant at Rachine, Wis., for the manufacture of passenger car and motor truck bodies, cabs, etc. Nelson formerly was superintendent of the body department of the Mitchell Motors Co. and Hansen for years conducted a trimming and painting shop in Racine.

Martin-Parry Co., York, Pa., has leased a large unit in the New Schwab Industrial Terminals at Lincoln Highway and Passaic river, Kearney, N. J. This unit contains over 50,000 square feet and will be utilized by the company for the manufacture and storage of commercial automobile bodies.

Western Body Mfg. Co., 763 Third St., North Minneapolis, Minn., manufacturer of automobile bodies, is considering the erection of a new three-story and basement factory. Plans will be prepared in the near future. E. F. Gross is president.

Great Atlantic & Pacific Tea Co., Provost St., Jersey City, N. J., will establish a new plant for the manufacture and repair of automobile truck bodies for company service. A list of machinery and equipment to be installed has been arranged.

General Motors Acceptance Corp., central offices, located in the Wurlitzer Building, 42nd street, New York City, will be removed to the main General Motors Building in New York at 224 West 57th street.

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIE

Vol. XLIII, No. 8 NEW YORK, NOVEMBER, 1921 $2.00 Per Y
Issued Mont

Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City. Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3.

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The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

Vol. LXIII NEW YORK, NOVEMBER, 1921 No. 8

Show Season Opened by Successful Closed Car Display

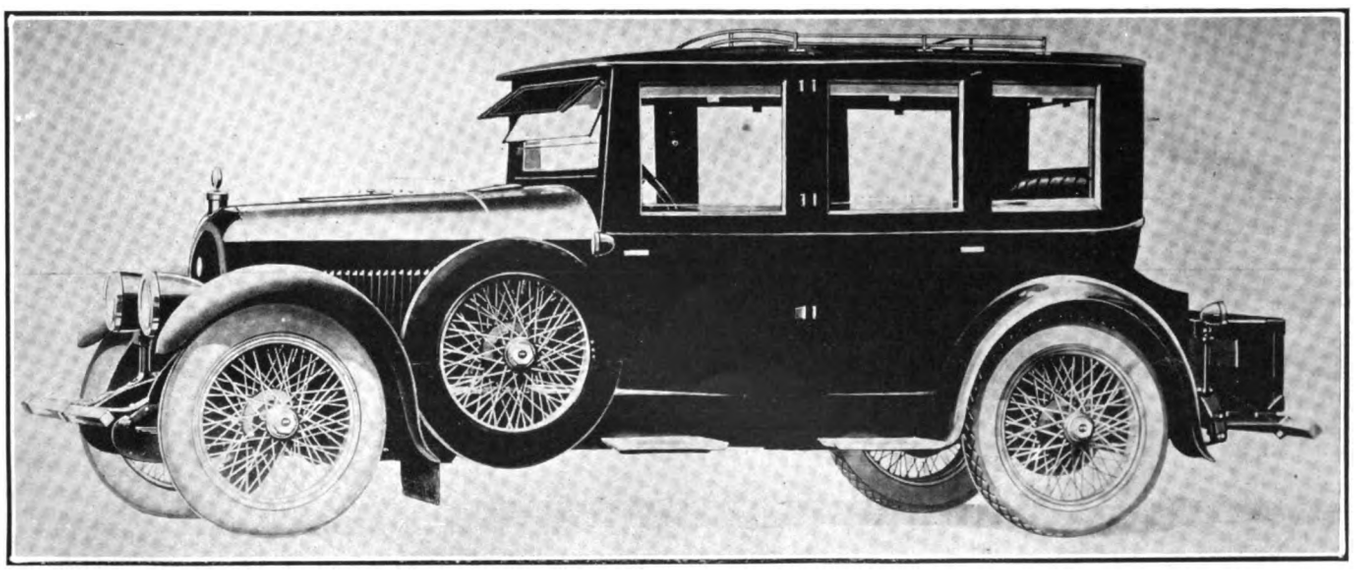
New Show of Closed Models Only Well Received, Much Business Done, Fair Attendance, Very Satisfactory to Local Dealers

THE show season of 1921-22 was very successfully opened in New York in the week of Nov. 14 to 19, by the new closed car display at the 12th Regt. Armory. This was somewhat of a departure, but both public or buyers and dealers or sellers proclaimed it a great success, and insisted that it would now be made an annual fixture. It was conceived and managed by the New York dealers, who believed that a display restricted to closed cars would meet with public approval just at this time. And it did, the public approved.

The idea was to bring out the latent interest in the closed car model, just at the threshold of winter, or late in the fall when most of the sales of closed models are made. It was held at just the right time, and the results proved that it was right in almost every particular.

This was the first time an exhibition has been held, devoted to one special form of body, but its timeliness combined with weather during the week, which drew marked attention to the discomforts of open car use late in November and the consequent comforts of closed car travel, proved that it was a splendid idea.

The majority of the New York dealers were represented, and as a consequence there was a very representative showing of the various makes. The range was from Fords, available at less than $1,000 to the Rolls-Royces, one of which was priced at close to 20 times that figure. There was however, a greater number relatively of the medium priced cars than of the more expensive ones which have been in the past most closely associated with the luxury and comfort (also expense) of close! bodies. If anything, it was the lack of the more expensive forms which detracted from the show as a whole. Thus among the better and high-priced makes which were absent were Locomobile, Pierce-Arrow, Stevens-Duryea, Winton,



The Kissel Coach Sedan, a four or five-passenger job of neat lines, somewhat unusual upholstery contour, and attractive painting.

Lincoln, McFarland, all of the importers, all of the higher class body builders, all of the electric cars, and many of the more moderate priced makes which are generally associated with quality bodies, such as Apperson, duPont, Stutz, H. C. S., and others, all of which are represented in New York.

However, it was perhaps just as well that these were not represented for their presence or the presence of any considrable part of the list just given would have overcrowded the hall, and would have taken away its air of cosiness and compactness, which was a large part of its attractiveness. There were just enough cars there so it was representative of all qualities, types and prices, and just few enough so that it was not overwhelming as the big national shows are.

A point which many of the exhibiting dealers made, and which perhaps accounts in large part for its success was that all of the attendance was from the nearby territory, that is New York and immediate vicinity. This meant that the dealers could hope to sell every person who came to the show and looked at the cars, for all of them were living within the territory of the dealers represented. At the national shows it was the complaint of many dealers that they spent much time and effort on supposed prospects only to find that they lived in a far-distant state, or even in a foreign country, so the dealers' time and efforts were wasted.

Attendance was above 2,000 on the opening night, and continued good throughout the week, although concentrated in the late afternoons and evenings. It was very largely, if not entirely, a buying attendance, and all the dealers reported very satisfactory sales and surprisingly good prospect lists as a result.

In the first three days, one dealer sold 21 cars, another 15, and a third 13, and others 12, 10 and so on down. A high-priced car dealer claimed 5 sales for the initial half of the week, and another 3. An accessory dealer, among the few showing on the balcony, reported contracts for $52,000 worth of radiator shutters to Wednesday night.

As an item showing the need for the show and its fitting into the general selling problem just at this time of the year, close tabs were kept on the people driving up in cars, and it was noted that more than 80 percent of these were in open cars. This it was said pointed conclusively to the interest in and need for, a show of this kind.

In a sense this display took away some of the thunder of the national display, as it marked the first showing of the new Durant models in any show, also the first for the new model Maxwell, the new models of the Buick four, Nash four, the new Mitchell models, and the new Halliday cars, the product of the Halliday Motors Corp., Newark, O.

There was considerable sameness to the display, the spaces being so proportioned that exhibitors were practically restricted to three models with adequate space around them, or four if crowded. This resulted in practically all of the dealers displaying a sedan, of five passenger capacity, a sedan of seven passenger capacity, and a smaller model variously called coupe, brougham, etc. This sameness with no outstanding types took away somewhat from the novelty of the show, as did also the painting. Practically all the cars were done in very dark colors, and the lighting was not particularly good at any time, day or night, so at first glance all the cars seemed to be painted all in black. On close inspection, or by asking questions, one found that this body was done in a very dark green, that one in a very dark blue, etc., but the prevailing color was dark, and the resultant impression of the show sombre. An idea of this can be gained from the simple statement that there were just eight cars in the show the color of which might be considered as light, and as many more which were light in part but inclining to dark, as a light color with black or dark trimmings, stripes, chassis and top.

There were a few, very few custom built jobs, just perhaps enough to make it impossible for a person to make the statement that all were standard jobs. Thus, the Stratton-Bliss Co. showed a special town brougham by Babcock on a Dodge 125-in. chassis, Rolls-Royce showed a salamanca cabriolet by Wood & Son, Marmon showed a New Haven special suburban sedan, and Roamer had a very neat brougham by Chapurdy.

The upholstery was quite like the painting and general body types, in that there was nothing new, little of novelty, and mostly of the dark, or at least darker colors and shades.

If there was any special tendency noted it was the attempt to bridge the chasm between the small or three passenger coupe, which is really not comfortable for more than two people, and the sedan with its complement of seven, or all-family car. This was seen in the number of small sedans of five or six passengers, the latter being the full length seven-passenger body but built narrower with straight sides. Between the coupe and the five-passenger sedan, there was a number of interesting forms, variously called enclosed drive carbiolet, enclosed drive brougham, small sedan, sport sedan, coupe, coach-sedan, etc. In the main these differed in the leg room afforded, and this of course, was dependent on the wheelbase. With the shorter wheelbases, it took the form of a modified clover leaf seating, in that the wider seat was drawn back of the driver's seat a considerable distance, and as this distance back increased, the width was increased by coming in behind the driver. When the wide seat is back far enough to give actual leg room behind the driver's seat, it becomes a full four passenger job with two parallel rows of seats for two each. Some of these, in fact the majority of these small-capacity sedans had but two doors. In that construction, it became necessary to fold, slide or otherwise move the seat next to the driver so as to permit entrance to and exit from the rear seats. The neatness with which this was accomplished determined whether the body was a practical job or not. And sorry to relate, not all of them were practical.

For a first attempt, it really was a good little show, and and the amount of business done and general interest displayed makes it certain that it will continue as an annual fixture. Next year, with different business conditions undoubtedly will see it a much better and more representative display.

New York's Used Car Show on Very High Plane

WHEN the New York dealers planned the closed car show, and arranged for the use of the 12th Regt. Armory for the same, they wisely retained the building for two weeks, and planned in the second week to display used cars. This unique show, said to be the first ever held in the country, proved to be very successful,

fully as much so as the first week when the new closed cars were displayed.

In one respect, it was an eye-opener to many people who attended, for the general character of the cars shown was so high they represented such high quality that a person found difficulty at first to connect them with the usual term of disdain, "used cars."

If the dealers continue to keep their cars taken in trade upon such a high plane, this term will soon lose its sense of derision, and instead become one representative of very sound values. It was with this thought that the show was undertaken, and it was in this spirit that it was carried out.

The dealers desired to show the public that it is advisable to buy their used cars from a recognized automobile dealer, rather than the so-called gyp, and that in so buying, they are certain to get good value, for the dealer is responsible and stands behind the cars he sells, new or second hand, both financially and morally.

The display of cars was changed throughout the week, some of the dealers with large stocks changing their displays from day to day. The range varied from approximately $750 up to 10 times that for a Rolls-Royce. All forms of body were shown from the runabout and standard touring, throughout the range of closed bodies, to the larger sedans.

In the main, all the cars were "reconstructed," that is had been gone over mechanically and thoroughly, and were sold with the new dealer's 90-day guarantee. If anything will solve the second-hand car problem of the dealer this general policy of putting cars back into shape and then selling them with a binding guarantee, and giving real service on them, should do it. And shows of the kind New York had from Nov. 21 to 26, will do much to acquaint the public with this new and sound policy, and thus redound to the benefit of both buyer and seller, as well as helping the automotive industry as a whole.

Receiver Named for Willys Corporation

Frank P. Kennison, vice president of the Ohio Savings Bank, Toledo, and Clem Miniger, president of the Electric Auto-Lite Corp., of Toledo, were appointed receivers Nov. 26 for the Willys Corp., Toledo, O., manufacturers of automobile accessories. The appointment was made in the federal court at Toledo by Judge John M. Killits and confirmed by federal judges in New York and Newark, N. J.

These proceedings do not affect the Willys-Overland Co., manufacturer of automobiles, which is said to be in a sound position with business showing constant improvement.

The embarrassment of Willys Corporation came about when it was overtaken by business depression a year ago, with its new automobile plant at Elizabeth, N. J., in an unfinished condition.

Steel-Studded Tires in London

Notice of new traffic regulations, which require every motor vehicle plying for hire in London to be equipped with at least two steel-studded tires, has been carried in the India Rubber Journal, London. Similar regulations in the past have not been enforced, but the announcement indicates that action will be taken against drivers who do not observe the new regulations, which are designed to promote greater safety for drivers, passengers, and pedestrians.

The New York Auto Show

Preparations for the national automobile shows in New York and Chicago are rapidly nearing completion. This will be the biggest and most comprehensive exhibition the country has ever known. The New York event, the first half of the show, will be held in Grand Central Palace, Jan. 7 to 14, and the Chicago event, the second half, in the Coliseum and Armory, Jan. 28 to Feb. 4.

One of the outstanding features of the 1922 show will be the great values in the cars displayed. Ever since the war motor car manufacturers have been profiting by the lessons learned when the plants were being used by the government, and as a result they have been able to reduce costs and at the same time show betterments in their products.

Automobiles surely are improving every year; the automobile shows reflect this. For the most part, however, the betterment has been noticed in body designs, coach work, finish both interior and exterior.

There will be 94 car manufacturers exhibiting on the four floors of the Palace in January, as against 88 last year and nearly 400 different models. Eight new makes of cars, including two foreign ones will be shown. These are the Bournonville, Handley-Knight, Rickenbacker, Wills St. Claire, Kelsey, Itala and Vauxhall. The last two named are the foreign makes that will be on display.

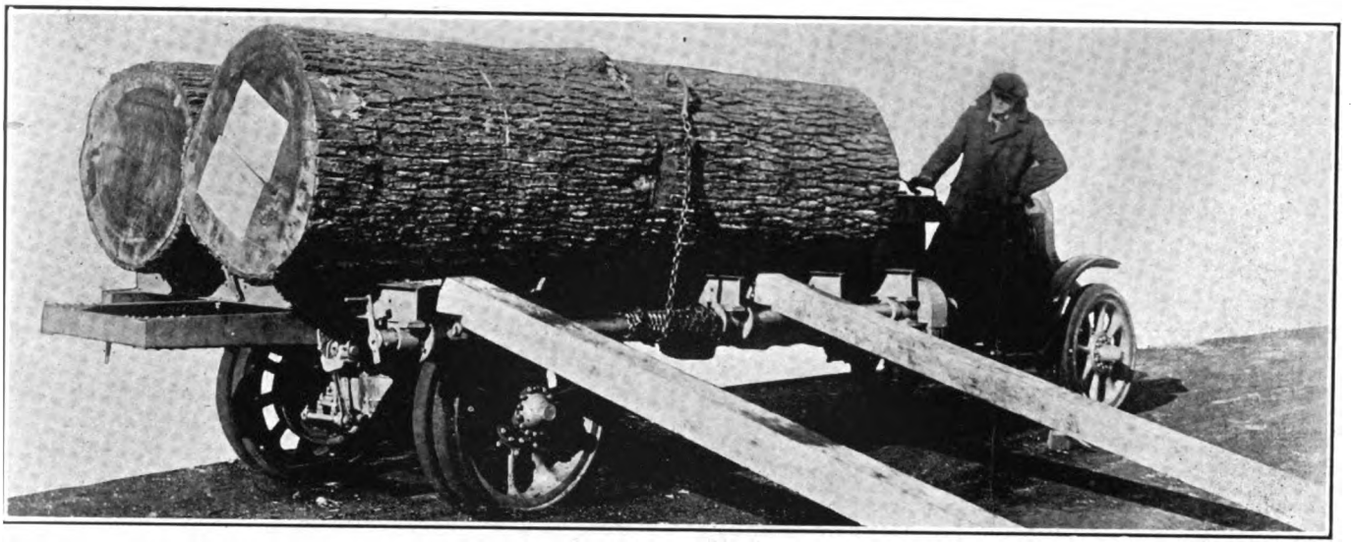
The New York exhibition will also show the biggest display of accessories that has ever been located under one roof, in spite of the fact that it was impossible to find space for many who applied for booths. The accessory booths number 233, and they will show a most varied line of devices and appliances that go to help the motorist.

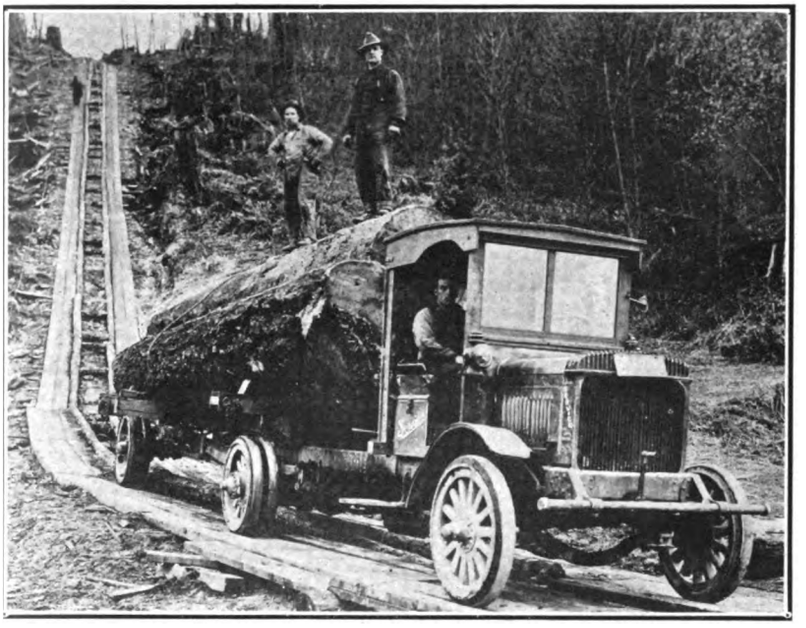
One of the features of the show week will be the many meetings, both business and social. These have not been all arranged but it is certain that the "Old Timers Club," composed of men who have been in the automobile trade since its infancy, will have one of the big parties of the week.

The following cars will be at the New York show: Ambassador, Anderson, Apperson, Auburn, Bournonville, Buick, Cadillac, Case, Chalmers, Chandler, Chevrolet, Cleveland, Cole, Columbia, Commonwealth, Crow-Elkhart, Davis, Detroit Electric, Dixie Flyer, Dodge Brothers, Dorris, Dort, DuPont, Durant, Earl, Elcar, Elgin, Essex, Franklin, Gardner, Grant, Handley-Knight, Hanson, Hatfield, Haynes, H. C. S., Holmes, Hudson, Hupmobile, Itala, Jackson, Jordon, Kelsey, King, Kissel Kar, Kline Kar, Lafayette, Leach Biltwell, Lexington, Liberty, Lincoln, Locomobile, McFarlan, Maibohm, Marmon, Maxwell, Mercer, Milburn, Mitchell, Monroe, Moon, Nash, National, Noma, Oakland, Oldsmobile, Overland, Packard, Paige, Paterson, Peerless, Pierce-Arrow, Pilot, Premier, Rauch-Lang, R & V Knight, Reo, Rickenbacker, Roamer, Saxon, Sayers, Standard, Stanley, Stearns-Knight, Stephens-Moline Plow Co., Stevens-Duryea, Studebaker, Stutz, Templar, Vauxhall, Velie, Westcott, Wills St. Claire, Willys-Knight.

All of these cars will be displayed at Chicago also with the exception of the DuPont, Kline, Ambassador, Noma, Leach-Biltwell, Hatfield, Bournonville, Essex, Rickenbacker, Kelsey, Itala, Vauxhall, Stanley.

Motor Trucks Help Lumbermen to Bring Out Huge Logs



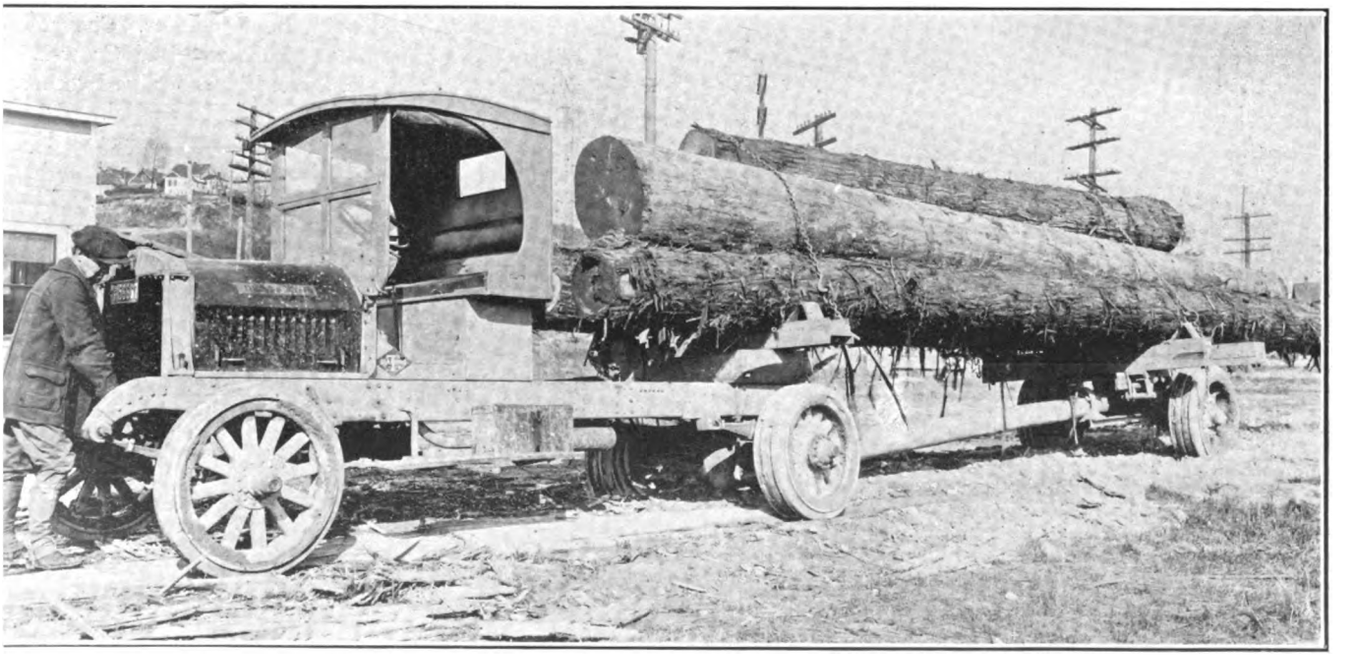


Lumbermen in the past have been greatly handicapped by the fact that they could get out large timber, in fact timber of any size, only when it was closely adjacent to a stream of sufficient size to float the logs or to a railroad. When a distance from the railroad the topography of the country was a governing factor inasmuch as by building temporary roads, generally of the corduroy type, some timber could be gotten out in good weather. This was a makeshift at best and an expensive one.

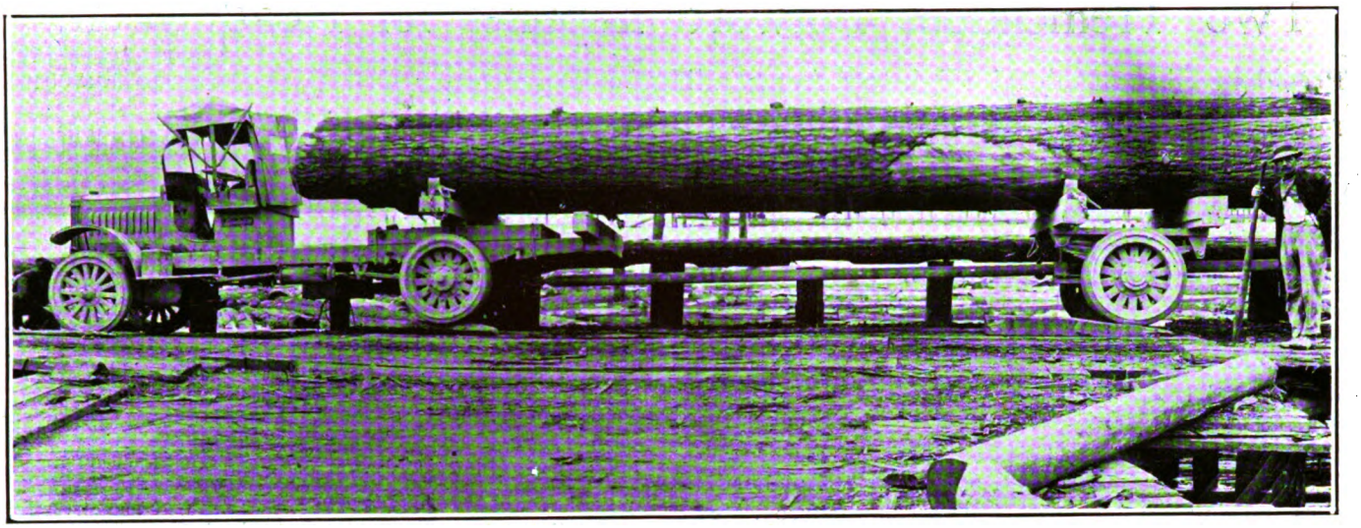
The motor truck has now invaded the realm of timbering, and proven very useful, adaptable and economical in this work. About all that is needed is a reasonable road, for unlike horses the truck can overcome grades. The illustrations on these pages show some of the trucks being used in lumbering work, as well as the almost universal adoption of trailers forced by the length of the usual timbers. Most of the trucks are of large capacity, either 4 or 5 tons capacity or larger.

Master truck with Amos log loader attachment bringing out two good-sized logs is shown at the top of this page. With this device, the motor is used to roll the logs to and onto the truck.

At the left is shown a Service 5-tonner



from Stands of Timber Inaccessible to Railroads



coming down an artificial "roadway" constructed for it. The foreshortened view gives little idea of the great length of the three logs.

Riker truck of 4 tons capacity in service of Smith & Olsen, Redmond, Wash. Shown bringing out three comparatively small logs. At the bototm of right-hand page.

At the top of right hand page is shown another 4-ton Riker in the service of Machias Mill Co., Woodenville, Wash. This gives a good idea of the length of the timbers handied.

Fruehauf adjustable pole trailer being used in connection with 3½-ton trucks by Tuscaloosa Cooperage Co., with headquarters at Tuscaloosa, Ala., to make 4 trips a day, 17 miles round trip, with 1,000 ft. log scale or approximately 6-7 tons weight. At the right.

Bottom photo on opposite page shows Diamond T truck used by Frank Johnson, Seattle, Wash., to haul out long heavy logs. Other trucks of this make are successfully handling equally large loads of timber, notably for the J. D. Esary Co., Utsalady, Wash., and other logging companies. Four to seven logs is an average load.

Two Tremendous Forward Impulses for Road Work

President Signs Federal Highway Act, Calling for Expenditure of $165,000,000, and Bureau of Public Roads Completes Distribution of War Vehicles

WITHIN the last month, two things happened which prove to be the biggest forward movements for further good roads work which have occurred in recent years. Early in November, the President signed the Federal Highway act, which thus became law, and about the same time, the Bureau of Public Roads, Department of Agriculture, announced that it had distributed more than 27,000 motor vehicles, comprising practically all the surplus war motors turned over by the War Department.

The former not alone carried an appropriation of $75,000,000 of federal funds, which must be matched by the states, making a total of $150,000,000, but appropriated $15,000,000 for improved roads in the national forests. The use of this large amount of money, totalling $165,000,000 and distributed over the entire country, will do much to reduce unemployment, and put more money into circulation besides the tremendous improvement which it will make on the country's total of improved and hard-surfaced roads. These in turn—with special emphasis on the better roads in the national forests which are emphatically public sight-seeing places—will do much to stimulate touring and thus, to increase motor car sales in the next few years. A further benefit will be noted in the complete dispersal of the surplus war vehicles, mostly trucks, which has overhung the truck industry for several years. The disposal of all of these, with the elimination of their threat against new truck sales, will have an immediate and important upward effect on motor truck sales. While the trucks given to the states for road work will all be put into use, additional trucks will certainly be needed for this work, especially if the majority of the states, as now appears, starts work immediately under this new act.

The $75,000,000 available for road construction in the various states is to be spent under the supervision of the Bureau of Public Roads, Department of Agriculture. This represents the federal government's appropriation to the work of building highways in the various states and must be matched, dollar for dollar, by funds from the state treasuries, except in states where more than 5 percent of the area is unappropriated public land.

This is for the fiscal year ending June 30, 1922, and $25,000,000 of the sum is available immediately, the balance becoming available on Jan. 1, 1922. Here is how the money will be apportioned among the 48 states:

State	Allotment	State	Allotment
Alabama	$1,553,420.67	Nebraska	$1,581,189.50
Arizona	1,053,281.44	Nevada	953,436.78
Arkansas	1,254,142.20	New Hampshire	365,625.00
California	2,462,098.53	New Jersey	942,870.95
Colodaro	1,341,175.69	New Mexico	1,189,823.34
Connecticut	480,897.78	New York	3,696,447.97
Delaware	365,625.00	North Carolina	1,709,333.90
Florida	886,825.69	North Dakota	1,164,714.42
Georgia	1,997,957.58	Ohio	2,823,004.05
Idaho	938,536.68	Oklahoma	1,752,339.44
Illinois	3,246,281.07	Oregon	1,182,663.90
Indiana	1,958,855.41	Pennsylvania	3,398,953.97
Iowa	2,102,872.74	Rhode Island	365,625.00
Kansas	2,102,281.51	South Carolina	1,061,237.34
Kentucky	1,417,178.68	South Dakota	1,204,060.31
Louisiana	996,989.64	Tennessee	1,647,692.24
Maine	695,160.25	Texas	4,425,172.41
Maryland	640,629.01	Utah	849,417.21
Massachusetts	1,096,176.04	Vermont	365,625.00
Michigan	2,249,532.43	Virginia	1,456,828.47
Minnesota	2,123,597.07	Washington	1,103,709.77
Mississippi	1,294,906.22	West Virginia	802,359.77
Missouri	2,448,128.62	Wisconsin	1,894,815.86
Montana	1,546,885.82	Wyoming	934,617.63

Of the appropriation of $15,000,000 for the improvement of national forest roads $5,000,000 is made available for the fiscal year ending June 30, 1922, and $10,000,000 for the following fiscal year.

The federal highway act resembles the federal aid act of 1916, but contains several new features. Administration of the act by the secretary of agriculture, and under him the Bureau of Public Roads, remains unchanged.

Apportionment to the states is almost the same as in the previous act, the fund being divided into three parts, according to population, area, and mileage of rural and star mail routes. A new feature is the stipulation that no state shall receive less than one-half of 1 percent of the total fund which, in this case, amounts to $365,625. This stipulation will increase the amount received by 4 of the smaller states: Delaware, New Hampshire, Rhode Island and Vermont.

Change in Use of State Allotments

There is considerable change, however, in the manner in which a state may use its allotment. Each state must select a connected road system not exceeding 7 percent of its road mileage for improvement with federal aid. This system will be divided into two classes, one of which will be known as interstate highways and the other as intercounty highways. The interstate highways must not exceed three-sevenths of the system selected; on them not more than 60 percent of the state's allotment can be spent without the joint approval of the secretary of agriculture and the state highway department. The intercounty highways, which consist of the remainder of the system selected, will receive the remainder of the state's allotment.

Except in states where more than 5 percent of the area is unappropriated public land, the amount of federal aid received on any project must not exceed 50 percent of the estimated cost. In states where more than 5 percent of the area is unappropriated public land the 50 percent allotment is increased by an amount equal to one-half the percentage of unappropriated public land in the state. Before any funds can be paid to a state, the state must appropriate money, under the direct control of the state highway department, to match the federal allotment, and for the maintenance of federal aid highways.

Minimum Road Width Specified

All highways in the interstate system must have a surfaced width of at least 18 ft., unless a narrower width is deemed permissable by the secretary of agriculture. In case a federal aid highway is not properly maintained by a state, the state will be given 90 days' notice by the department; at the end of that time if the highway is not in good condition of maintenance the secretary of agriculture will maintain it out of the state's allotment and refuse to approve any new projects until reimbursement is made by the state.

What the new appropriation will mean to the country can be judged by the use made of the $275,000,000 previously appropriated, according to officials of the U. S. Department of Agriculture. Practically $200,000,000 of

that money has been put to work in projects which are either entirely completed or now under construction. The exact amount was $199,823,427 on Oct. 31. To match this amount the states have appropriated $265,529,090, making a total of $465,352,517.

Mileage Sufficient to Encircle the Earth

The roads to be paid for by this money, if placed end to end, would encircle the earth and extend from New York to San Francisco on the second lap, the total mileage of the roads under construction and completed being reported by the Bureau of Public Roads as 27,000 miles on Oct. 31. Of this mileage 9,555 miles is in project which are entirely completed and the contractors discharged. The balance of 17,445 miles is in projects which are still under construction, but which were 69 percent complete on Oct. 31. In these projects there is therefore the equivalent of 12,000 miles of completed road, so that the completed road to date totals over 21,000 miles.

Hard Surfaced, Permanent Roads Predominate

The average cost per mile of the roads built with federal aid has been between $17,000 and $18,000. More than half the money has been spent for roads with the highest types of surface, such as concrete, brick, and bitumonous concrete, but a very large mileage of roads of the cheaper type, such as gravel and sand-clay, has been built where such types would withstand the lighter traffic.

Prior to five years ago the federal government took no active part in the road construction of the country. Today about one-half of all the roads that are being built are being aided by the government financially, and the construction is subject to the inspection and approval of federal engineers.

Work for Quarter Million Men

It is estimated by engineers of the U. S. Department of Agriculture that the federal aid roads under construction on Oct. 31 were giving employment to about 250,000 men, either directly on the actual road construction or indirectly in the production and transportation of the materials which enter into the construction.

The new act, just signed, will, it is stated, keep these men at work, so far as weather conditions will permit, and thereby prevent the unemployment situation from becoming more serious. Without the new appropriation many of the states would soon have been forced to curtail their work for lack of funds.

In the matter of the distribution of the surplus war vehicles, the allotment of these was based on the amount of money the states proposed to spend on road construction. On this basis, Texas received the largest number, followed by New York and Illinois. The distribution carried only one condition, that they be used for road building purposes only.

How the War Vehicles Were Distributed

To Oct. 31, a total of 27,198 had been distributed under this plan, including 1,800 retained by the Department of Agriculture to be used on the national forest roads and in connection with the administration of the federal aid act. It is said that these vehicles comprise virtually all the surplus motor vehicles turned over to the Department of Agriculture by the War Department to be distributed under the Wadsworth-Kahn act among the states for road building purposes. These vehicles, consisting mostly of motor trucks, are a part of the war materials originally intended for use in France.

The number of motor vehicles distributed to the states up to Oct. 31 was as follows:

	Truck	Autos	Total		Truck	Autos	Total
Alabama	440	105	545	New Hamp.	105	16	121
Arizona	352	25	377	New Jersey	299	73	372
Arkansas	414	68	482	New Mexico	352	50	402
California	716	133	849	New York	1,132	162	1,294
Colorado	403	57	460	North Carolina	620	112	732
Connecticut	153	24	177	North Dakota.	341	46	387
Delaware	50	12	62	Ohio	845	149	994
Florida	239	56	295	Oklahoma	479	59	538
Georgia	581	159	740	Oregon	314	34	348
Idaho	271	32	303	Pennsylvania	837	136	973
Illinois	1,006	169	1,175	Rhode Island	57	10	67
Indiana	629	115	744	South Carolina	355	64	419
Iowa	679	93	772	South Dakota.	380	60	440
Kansas	724	106	830	Tennessee	488	94	582
Kentucky	444	75	519	Texas	1,321	203	1,524
Louisiana	292	49	341	Utah	238	23	261
Maine	177	34	211	Vermont	106	12	118
Maryland	211	26	237	Virginia	420	76	496
Massachusetts.	212	61	273	Washington	357	68	425
Michigan	710	121	831	West Virginia.	337	49	586
Minnesota	617	84	701	Wisconsin	581	102	683
Mississippi	414	70	484	Wyoming	229	28	257
Missouri	797	106	903	Dept. of Agriculture	1,303	497	1,800
Montana	407	64	471				
Nebraska	447	85	532				
Nevada	229	36	265	Total	23,110	4,088	27,198

Tube and Tire Exports Decrease

Sixty-three automobile tire manufacturers reporting their September production and shipment figures to the Rubber Association of America, Inc., show total exports of 40,557 automobile tire casings, divided as follows: Inch-size clincher cord, 1,694; inch-size straight size cord, 8,108; inch-size clincher fabric, 19,667; inch-size straight-side fabric, 4,889; metric casings, fabrics or cord not specified, 6,199. In August, 55,356 casings were exported by the companies reporting, so that September shows a decline of more than 26 percent.

The total number of inch-size inner tubes exported by the companies contributing to the figures was 18,519, and of metric size tubes, 4,761. The small-car sizes. 30 by 3, 30 by 3½, and 31 by 4, led with 3,201, 5,118, and 1,526, respectively. The next important inch sizes were 32 by 4½, credited with 2,807 tubes, and 33 by 4, credited with 829. In the metric line, 760 by 90 was the most important size, followed by 815 by 105 and 820 by 120.

Solid-tire exports in September were reported to the association by 11 manufacturers, who comprise an almost complete list of the companies producing them. The number of solid tires exported in inch sizes were 1,754, and in metric sizes, 473. These figures are both decreases from the August exports. The sizes of solid tires in which the greatest numbers were exported are 36 by 4, 36 by 5, 34 by 4, 32 by 3½, 40 by 6, and 36 by 6.

New German Cycle Car

The Zahn Co., Ltd., has recently introduced a small two-seated 4 to 9 horsepower cycle car, which is to take in Germany the place now occupied by the modestly priced passenger cars of two-seat capacity only in the United States. It is claimed to be cheap in price, cheap in upkeep, and simple in construction.

The car sells at retail in Germany for 40,000 paper marks (about $323, at exchange rate on Oct. 5, the date of report). It has a torpedo-shaped wooden body about 9 ft. long, with a maximum width of about 4 ft. The motor is of a two-cylinder air-cooled V-formed construction. The gas is regulated by foot pedal and hand lever. The car weighs about 300 kilograms, develops a speed of from 60 to 65 kilometers an hour, and consumes about 5 liters of gasoline and about one-half liter of oil per 100 kilometers.

Special Motor Cars Used for Testing Casing Gas

BY F. I. THOMPSON*

Small Traveling Laboratories Built on Motor Car Chassis to Permit Testing of Gas in the Field at the Gas Well

CASINGHEAD gasoline is the trade name for the very light, extremely volatile liquid which condenses in the heads of oil wells, and the heavier gases which carry this desirable liquid are called casinghead gases. These are not necessary in the sale of the natural gas, nor of the oil, and when the gases are condensed, they yield a high-class gasoline which sells for a good price. Consequently, the oil and gas men desire to sell them for the sake of the additional revenue. Less than two years ago, when the casinghead gasoline industry, if it can be called an industry, was in its infancy, most of the mid-continent oil producers entered into contracts for the sale of this gas. Plants for condensing it were built wherever the volume justified it, and some of these returned a good profit.

Experience quickly revealed however that much of the casinghead gas did not contain enough gasoline to justify plant operation. Quantities of gas could not be conveniently carried to laboratories to be tested. It was not practical to pipe it for that purpose.

Thus necessity brought about the development of the test car, a miniature gasoline plant built on an automobile, to test the casinghead gas at the wells for its gasoline content—the number of gallons of gasoline that may be obtained from each thousand cubic feet of gas. These tests are known as physical field tests for gasoline content, and the result is called the test yield of the gas, to distinguish it from the plant yield.

The use of the test car saves thousands of dollars each year for the buyers of casinghead gas, and insures the sellers an equitable method of determining value in disposing of their product.

Besides arriving at the gallons per thousand cubic feet for purposes of settlement, the test car has its use in the daily operation of gasoline plants. By it the critical pressure (the pressure at which the greatest yield is obtained) is found without disturbing the manufacturing process. It is also useful in maintaining the efficiency of the plants and in separating the gases of varying qualities to obtain the maximum yields.

The two principal methods in use to determine the yield in gallons per thousand cubic feet of gas are by compression and absorption tests. There is also the chemical test for the gasoline series in casinghead gas, but this test is seldom used in the field.

The compression test is most frequently employed, and is usually designated in the gas selling contract, as the method to be followed in the so-called settlement tests, to arrive at the price to be paid the seller per thousand cubic feet for the gas until the next test is made. These tests are usually made quarterly or semi-annually.

The ordinary single-stage gas testing equipment consists of a small scrubber tank to free the incoming gas from water and whatever oil it may contain, a meter, a single-stage compressor, cooling coil and tank, and a reservoir called the accumulator tank for collecting the gasoline as it comes from the coils while still under 200-300 lbs. pressure. There are also the necessary gauges for controlling the pressure. All this is mounted on the rear of an automobile. The power for operation is obtained from the automobile engine by jacking up a rear wheel and connecting it to the pulley of the compressor by a belt over a belt band on the rear axle.

In the compression method, gasoline is manufactured from casinghead gas in the gasoline plants by compressing the gas in two stages, first by low-pressure and then by high-pressure compressors. With the purpose in view to more closely approximate plant production, the Tidal Gasoline Co. found it necessary in its Oklahoma operations to develop a more efficient car than previously used. Instead of the ordinary single-stage high-pressure apparatus, the writer helped design and build this two-stage, vacuum pump equipped test car, and also the two-stage machine used in Tidal Western activities in Texas. This apparatus has also an advantage in that the power is furnished from the engine through an auxiliary shaft direct from the transmission, which eliminates jacking up the rear wheel for power when in operation.

In the principle of operation this car is not very different from the single-stage machine in general use. However, it more nearly parallels the gasoline plant. Its vacuum pump permits of connecting into the lines carrying the gas under the vacuum without the closing of any gates and a consequential loss of gas to the plant for several hours, and without loss of time to the gas tester waiting for pressure to build up on the particular lease to be tested. The two-stage compressor with both low and high-pressure cylinders necessitates the use of two sets of coils and accumulators.

The change in machine however, does not modify the procedure of testing. This is governed by the rules and regulations made by the United States Interior Department. The minimum number of cubic feet of gas run in a test is 10. In order to eliminate errors in field calculations, 26 42/100 cu. ft. of gas are used, as this amount passing through the meter at 4 oz. of pressure yields one gallon of gasoline per thousand cu. ft. of gas for every 100 c.c. of gasoline recovered. This is measured with the gasoline at atmospheric pressure after the temperature is raised to 60 deg. F. at a rate not to exceed 1 deg. every 2 min.

Now, we are ready to run a test. We drive up to a scrubber tank, or to a meter set in the vacuum line—the pipe through which gas is drawn from the wells—and make our connection into it with a flexible rubber hose. This hose runs to the small scrubber tank on our machine and is set in the suction line of our machine's vacuum pump. Our vacuum pump discharges or forces the gas at 4 oz. pressure through the meter and into the low-pressure cylinder, which puts it under 40-60 lb. pressure. The gas compressed now passes through the low-

Continued on page 23

Tide Water Topics.

* Gas and Meter Tester, Tidal Gasoline Co. Reprinted from

Advantages of the Lumber Standardization Movements

BY DAVID G. WHITE*

The Necessity for Standardization and How It Will Benefit All Concerned from the Cutter to the User—Body Builders' Interests

WHILE it is true that a great number of automobile and truck bodies are built of metal, and that this number is increasing each year, it is still a fact that wood is the major body building material, and anything which pertains solely to wood is of intense interest to body and coach builders as a class. For these reasons, the present movement toward the standardization of lumber products as to quality, sizes, nomenclature and otherwise comes home to them forcefully. It is pointed out that lack of such standardization increases litigation, buying expenses, the misuse and waste of lumber, loss of good will and common honesty, and stimulates cut-throat competition, the blending or substitution of grades and dissatisfaction generally. A striking example is shown in a recent decision of the arbitration department of the American Wholesale Lumber Association. A buyer purchased three cars of inch spruce lumber which had an actual S2S thickness of 25/32 in., but which was satisfactory for the use intended. Shortly afterwards he ordered a car of fir intending to put it to the same use as the spruce. The fir was surfaced to ¾ in. which was the standard thickness as provided in the rules governing the same, but as it was too thin for the purpose intended, the customer rejected it. The arbitration court decided, that since the customer had failed to specify the thickness, that the shipper should not be penalized for ignorance on the part of the purchaser covering the standard sizes of the various woods and held further that the purchaser should pay the seller in full together with demurrage charges and all other expenses accumulating against the shipment.

But what do we mean by the standardization of lumber and what are the objects to be attained in standardizing it? In its broader aspects this subject pertains to the sizes, grades and specifications, and nomenclature of wooden products, including lumber, cross ties, dimension stock, and the like. Standardization, therefore, means, first, that the actual as well as the nominal sizes shall be uniform for all specified dimensions of the different woods; second, that the grades within the various classes of lumber having similar uses, such as the grades of finish, factory, structural, and common, shall be uniform for all woods; and third, that each wood have one scientific and one common name rather than having so many names that they rival the tongues spoken in building the tower of Babel with the same resulting confusion. A unified procedure by manufacturers in producing a standardized product would certainly (1) simplify the purchase of lumber by making possible a common language for all; (2) increase the efficiency, ease and accuracy of lumber inspection; (3) render possible the substitution of one species for another with assurance of getting the species desired and of the same size and grade; (4) simplify the building design for the architect; (5) render statistical interpretation more intelligible in comparing prices of competitive species, sizes and grades; (6) make for the uniformity in construction; and (7) make the material more salable by increasing the consumers' good will.

It is not the intention, however, to criticize the lumber industry for conditions which must practically always accompany the rapid development of a pioneer industry, covering such diversified conditions as existed in our primeval forests and laboring under the keenest regional and species competition. Rather, an effort will be made to acquaint you with the status of the movement towards lumber standardization which has been taking shape during the past few years and to point out ways and means whereby through a carefully coordinated plan of cooperation between consumers and manufacturers the forest service believes standardization may be effectively attained.

Lumber

Regional lumber manufacturers' associations, for the most part, are the agencies which establish and promulgate the sizes, grades and specifications, and names of the various woods manufactured in the territory covered by each association. There are about two dozen different booklets used by the various associations in describing the hundreds of sizes, grades and specifications. In addition, there are the countless specifications of individual manufacturers, wood consuming factories, government departments, etc. The situation is complicated by the fact that a number of different woods may be graded under one set of rules in one association and under different rules in the same or different territories.

In general, there are the two classes of wood, softwoods and hardwoods. The softwood interests are practically all identified with the National Lumber Manufacturers' Association and the hardwood interests express their will through the grading rules committee of the National Hardwood Lumber Association. Different uses for these two classes of woods further complicate standardization.

Hardwood Associations

Very progressive steps have been taken within the hardwood lumber industry during the past three or four years so that we now have the one group of rules endorsed by the National Hardwood Lumber Association, the American Hardwood Manufacturers' Association, the Michigan Hardwood Manufacturers' Association, and the Northern Hemlock and Hardwood Manufacturers' Association. Inherent differences between hardwood species have resulted in variations in grading the different woods, although it may be possible to unify these to a larger extent than is done at present. Furthermore, both the softwoods and hardwoods have many characteristics in common that can be standardized, such as the thickness of lumber, difinitions of defects and blemishes, and the grading of finish and many grades of lumber.

American Lumber Congress

The differences between the hardwoods and softwoods and especially the differences between various softwoods, constant changes in rules and sizes, and the ever increas-

* Forest examiner, Forest Products Lab., Madison, Wis. Abstract of paper presented before Nat'l Assn. of Purch. Agents, Indianapolis, Oct., 1921.

ing demands of the consumers for lumber of satisfactory common standards for their requirements, stimulated the first American lumber congress, which was held in Chicago on April 14 to 17, 1919, under the auspices of the National Lumber Manufacturers' Association, to adopt the following resolution:

"Resolved, That it is the sense of this lumber congress that there should be uniformity of sizes in all lumber and moldings manufactured in the United States and that for the accomplishment of this purpose the secretary-manager of the National Lumber Manufacturers' Association be requested to call a meeting of the proper representatives of all associations represented in this congress at Chicago within 60 days from this date."

In compliance with this resolution, about 40 representatives of lumber associations, manufacturers, wholesalers, retailers, architects, engineers, and the trade press met in Chicago on June 30, 1919. Resolutions were adopted at this conference calling attention to the need for standard sizes, grades, forms and nomenclature for lumber, moldings, and shingles. A plan for future work was outlined which would solicit the help of manufacturers, wholesalers, retailers, architects, engineers, the Forest Products Laboratory, and others interested.

A second conference was held in Chicago on Sept. 28 and 29, 1920. This conference was widely heralded by the press and was well attended by representatives of the associations and organizations previously mentioned. September 28 was given over to a discussion of sizes of common boards and strips, dimension, finish, flooring, ceiling, partition, grooved roofing, fencing, drop siding D. & M., drop siding, worked shiplap and rustic, shiplap, and bevel siding. With but minor changes the conference referred the sizes back to the manufacturers with the request that they be officially adopted and put into practice at once.

Sept. 29 was devoted to patterns and sizes of moldings. The types of moldings were based largely on the recommendations of architects. The manufacturers and retailers were mainly interested in reducing the necessity of manufacturing and carry stocks of little-used patterns. It was believed that better sales would result through concentration of a limited number of patterns recommended by architects designed to give approved artistic effects. With minor changes the patterns were approved by the conference and referred back to the lumber manufacturers for adoption.

The National Lumber Manufacturers' Association, being an association of regional or species associations, was never given the power to put the recommended standards into effect, and as the representatives of the various regional associations were not vested with authority to approve the conference recommendations for their respective associations, adoptions of common standards by the different manufacturers' associations has never been effected.

Association action on lumber grades and nomenclature is being deferred by the National Lumber Manufacturers' Association until some definite action is taken on sizes.

American Engineering Standards Committee

In the meantime another organization became interested in the standardization of wooden products, the American Engineering Standards Committee. This is an organization consisting of a committee appointed by the big engineering societies, departments of the government, architects, fire protective and electrical associations, national safety council, etc. The object of this committee is to unify and simplify the methods of arriving at standards, to secure cooperation between the different societies, and to prevent duplication of work. Because of the strength of the affiliated organizations represented by this committee, it bids fair to become the most powerful and influential body striving for national and international standards. The department of agriculture, as a member of this committee, has three representatives, one of which is a member of the United States forest service. At the request of any responsible organization desiring standards for its products, the committee meets and carefully reviews the situation to determine if standardization will better serve the public, if the attitude of other interested organizations is sympathetic, the present status of standardization within the industry, and the acceptability of the proposed standards to the public. If the report of the committee is favorable, sponsors are appointed whose duty it is to see that action does not lag unnecessarily in driving forward the proposed or otherwise acceptable standards to a successful termination.

The forest service, which controls vast timbered areas owned by the public, is naturally the logical representative in so far as wooden products are concerned. It has felt for some time that lack of standardization within this field is prejudicial to the best interests of the public and the industries and especially to the most economical utilization of our remaining forests. At its suggestion, the American Engineering Standards committee now has under consideration the calling of a conference for the purpose of bringing together all interests to be affected by standardizing lumber sizes, grades, and nomenclature.

Due to the fact that all phases of lumber standardization have not progressed to the same stage, and also to the fact that different organizations are interested in different phases of the subject, it is probable that more than one conference will be called and that the subjects will be presented in the following order: first, sizes; second, nomenclature; and third, grades and specifications.

Nomenclature to Clear Up Confusion

The adoption of standard common and scientific names of trees and woods will go far in clearing up some of the confusion and camouflage now prevailing with respect to both competitive and little known species. It will serve to bring out a clearer knowledge of the uses to which our various woods are best adapted. Much dissatisfaction with wood in general resulting in the increase of substitutes, can be traced directly to confusion in present trade names. Innumerable letters are written by the forest service answering queries as to the differences between two or more woods which were probably the same species, such as, "What is the difference between Arizona white pine and California white pine?" between "tupelo and gum?" between "tamarack, juniper and hackmatack?" etc.

It is not surprising that there should be a great deal of confusion on this subject when we consider that there are at least 600 different species of trees native to the United States, of which there are approximately 100 softwoods and 500 hardwoods. There are as many as 35 to 40 species of pine, about 70 species of oak, etc. Containing the overlapping of names, the 35 to 40 species of pine alone are known by about 300 common names, or an average of eight names apiece. Longleaf pine is known by at least

29 local or generally used names, lobolly pine 23, western yellow pine 21, ad infinitum.

In general, scientific names are supposed to be governed by an international code agreed upon by botanists, the latest rulings of which were laid down at the Vienna Congress of 1905. There is still, however, some confusion in this country concerning the scientific names of some trees and an endless confusion in common names. Names considered as standard for use within the United States forest service are published in Forest Service Bulletin No. 17, "Check List of the Forest Trees of the United States, Their Names and Ranges."* Changes made since 1898, when this bulletin was published, have been extremely rare. This check list will be used as a basis in making recommendations to a nomenclature conference to be called by the American Engineering Standards committee.

Grades and Specifications

Fundamental to standard grades and specifications are the questions of definitions of defects and blemishes, the effect of the kind, size, and location of defects in relation to their effect on strength, the determination of equivalent defects in material to be used for the same or similar purposes, and the like. A great deal of this information has already been prepared by the Forest Products Laboratory.

A careful analysis is being made of all the commercial grading rules in order that none of the practical aspects of grading the various woods may be omitted and also that the so-called inherent defects peculiar to the different woods may be given their proper weight in the order of grades.

Several sub-divisions will be necessary so that there will be grades covering finish stock, softwood shop or factory grades, hardwood cut-up grades, structural timbers and common grades. Specifications for flooring, tank stock, shiplap, siding, and other special products, will be made by using the necessary basic finish or common grade and then stating such expectations as are necessary to render the stock suitable for a given use.

Some work has already been done by the forest service and the National Lumber Manufacturers' Association in determining basic grades for finish and common. The National Hardwood Lumber Association has accomplished a great deal on their common grades, referred to previously as cut-up grades because they are generally cut into small dimension stock before using. Standards for select structural timbers have been worked out by the laboratory, based on hundreds of thousands of tests of the various woods. These standards are being approved by the American Society of Testing Materials. This society in joint action with the forest service will probably request their adoption by the American Engineering Standards committee.

Cross Ties

Special wooden products, such as cross ties, are receiving attention as the necessity arises. Since the United States Railroad Administration attempted to unify specifications for purchasing ties for the railroads under its control, the American Railway Engineering Association and the National Association of Railroad Tie Producers have developed standards which vary in minor respects only. These specifications will serve as a basis for establishing American standards in a conference to be called in the near future by the American Engineering Standards committee.

Small Dimension Stock

Another activity of major importance relates to material commonly known by various names such as small dimension stock, squares, blanks, bars, and other local and generally used names. High prices, rapidly diminishing forests, and the importance of utilizing present waste as an important phase of a sound national forest policy, resulted in the Association of Wood-Using Industries calling public and congressional attention to the need for investigation of this problem by the Forest Products Laboratory. Factory studies are now under way to determine the class of material required for given uses. When these data are collected it is proposed to recommend grading rules and specifications covering this class of stock.

Successful American standards can be achieved only through the heartiest and fullest cooperation of all consumers and manufacturers. This great organization of purchasing agents unquestionably is vitally interested in a movement which seeks to simplify and to insure common clear-cut standards in the buying and selling of lumber and lumber products. Your interest is great, your participation is needed and your support will be heartily welcomed.

* A copy of this bulletin may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 15 cents, cash or money order.

Standardized Machine Parts

An important saving can be effected in machine shop practice by extending the standardization of machine tool parts. If it were possible, for example, for lathe manufacturers to agree upon certain standards for toolposts, face plates, spindle noses, and other parts, this standardization would result in considerable economies in all shops where machine tools are used. It would be comparatively easy to arrive at some common standard for T-slots for machines of similar type and size, continues "Machinery." Another important extension of standardization concerns the motor builder rather than the machine tool builder. Motor manufacturers have not as yet been able to agree upon such standard dimensions for electric motors as will enable the manufacturer to place any make of motor of a given size and for a given current on his machine, without special provision for it. The motor manufacturers have made great progress in standardizing the electrical details, but apparently they do not yet fully appreciate the value of what may be called "mechanical standardization." By cooperation the motor manufacturers could agree upon certain frame designs that would place the shaft for the pulley at a given height above the support. The locatio nof bolt holes should also be uniform, and the shaft diameter should be standardization so that the same pulley will fit on any motor of the same size and for the same current, irrespective of the make.

An international automobile race will be run from Santiago, Chile, to Buenos Aires, Argentina, on February 1, 1922. The race will be open to all classes of automobiles, and is being held under the auspices of La Nacion, of Buenos Aires, and El Mercurio, of Santiago. The first prize will be 20,000 pesos. Races of this kind are one of the best methods for advertising American automobiles in these countries.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO

Heptagon Building, 153 Waverly Place, New York City

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXII November, 1921 No. 8

What the New Year Promises

THOSE critics of the automobile who consider that it has reached perfection and henceforth may be expected to go slowly backward are going to be confounded by the developments on the next six months or so. In this period the announcement of the new models, and new refinements of older models are to be made, and judging from all reports, some of them will be of marked importance.

One maker has just announced new light-weight pistons of aluminum, which can not slap nor stick. Besides these three advantages, they give much improved acceleration, a quality which the public has always been ready and willing to pay for. This same maker has also improved his brakes through increased leverage, better arrangement, and small niceties of design, so that the braking practice previously considered the best has been improved upon by about 10 percent on the average. This too, is something the driving public has always wanted and has been equally willing to pay for.

Other makes which are unchanged in basic design have other equally desirable new detail features, and there are enough of these so that their sum total on one car would make it as radically different from the 1921 models in performance, economy, long life, safety and other desirable qualities, as the latter was different from and better than the 1918 models.

In new designs, the stress of the competition at present and to come has been shown in somewhat the same way, the revealing of many new things, either in simplification and lowered first or operating cost on the one hand, or superior performance in the higher-priced cars. For one thing, two new steam cars at low prices are about to come onto the market in quantities, and the performance of these is going to make most of the cars under $1,000 hustle to hold their positions. It is known too that several makers are about satisfied with their long experiments on new air-cooled cars, and these may come onto the market in quantities, and at remarkably low prices, in the 1922 season. If they do, there will be a number of older cars which will have to be improved to a marked extent to survive.

The English seem to have turned to the one and two-cylinder, air-cooled car in the lowest price class, and it is just possible that something close to the English lines may be brought out to compete with Ford, Chevrolet, Overland and other cars listing below $600. In case this is done it means that each and every car in this lowest priced class will be reduced in price by a remarkable amount, for there are no factories in the world so well organized for huge production, and thus, absolutely the lowest possible costs, as these three. It is just possible that the continued cry of economy may bring about a recrudescence of the cyclecar boom, but in a modified form which might pull it through.

Taken altogether, it appears that the present combination of circumstances may bring about within the coming season improvements and advances in motor cars, in all classes from the smallest to the largest, from the flivver to the $15,000 car, which ordinarily would not have developed in four or five years of pre-war business

The General Fuel Situation

DESPITE the fact that the month of September was not a good touring month, government statistics on the fuel situation show that in that month the storage supply of gasoline was reduced by some 52,000,000 gallons, and now amounts to but 515,000,000 gallons. This reduction, in the face of lowering of consumption for the month by 65,000,000 gallons, shows that the fuel situation is a bad one, for production is still lagging behind consumption.

September is normally a month in which production continues while consumption begins to fall off, so that the storage supply generally begins to build up in that month, continuing through the colder months and early spring, only to be sharply reduced when touring starts, and cut into very heavily during June, July and August.

Tire Prices Dropping Now

FOLLOWING the car situation in which prices have been cut heavily all around, and have now about reached the end of the first cycle, accessories of all kinds and particularly tires have been cut in price. This movement started about six weeks ago with one of the large and two of the middle sized firms, but has now extended throughout the industry, and prices have reached a point where all of them are down to a lower level.

Yet some of the makers are not getting the business they anticipated through the cut, and with the low priced rubber and lower priced fabrics and cords now being used to the extent of 100 percent in tire construction, there seems the possibility, unsettling as it would be, of further price cutting.

There are 5,000 omnibuses in regular operation in England carrying 25 to 30 persons with an average speed of 20 m. p. h. They make 14 trips through Wales at a charge of $112. They are now taking passengers from London to the Scottish Highlands, a 17-day trip, with the best hotel service, for a fare of $150.

Progress of Commercial Aviation

Developments of the War and Subsequently Which Have Influenced or Will Influence Air Traffic—Close Relation to Military—Need for Subsidy and for Proper Air Laws

ONE of the real benefits which the world has derived from the war is commercial aviation, for no one will deny that it got almost its whole progress from infancy to near-perfection in, through or as a result of war uses. In fact, as the various commercial projects stand today many of them, perhaps a majority, are operating with war equipment. The war left practically all the belligerents with tremendous stock of completed planes and materials for many thousands more, for which at that time there was no outlet. The sale of these at modest prices has permitted the starting of many commercial air services, since it enabled the promoters to start at a modest expense. This has been and is highly important to transportaion via air since the traffic in the way of freight or passengers has not yet reached a stage where it is profitable to the promoters upon normal commercial basis of expenditure.

The sale of these tremendous stocks of course, has a very adverse effect upon aircraft manufacturers, in fact it prostrated their business for the time being, but considered in the light of the greatest good for the greatest number this movement can only be looked upon as beneficial.

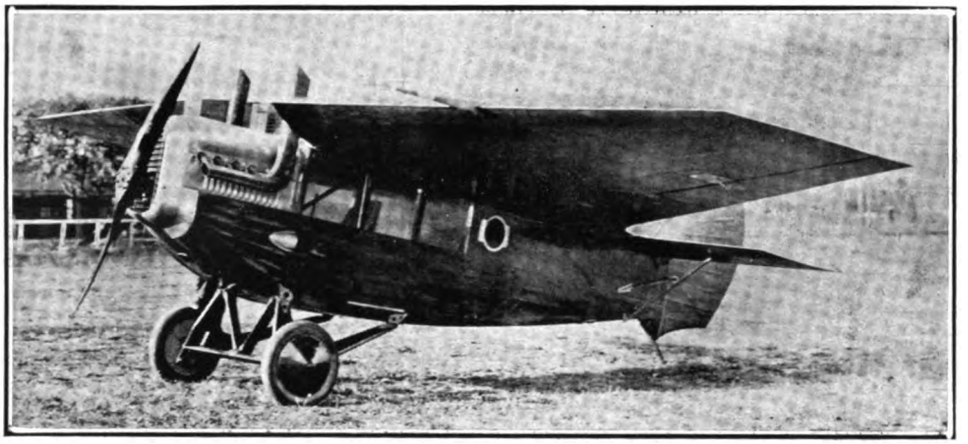


Fig. 2. New type of all-veneer, all-enclosed plane developed since the war especially for commercial aviation.

The progress of commercial aviation is closely tied up to military aviation and must continue to be as long as military establishments exist, says the Commerce Monthly, New York, on this subject. This relationship may be compared in kind to that of the navy and the mercantile marine. In degree it is much closer. In case of war the expansion of the air service must necessarily be much faster and greater than naval expansion. By so much more must the air force be dependent upon commercial aviation than the navy upon the mercantile marine, as a source of material and personnel. The prohibitive cost of maintaining anything more than a nucleus for the enormous organization of a wartime air service explains the necessity, already recognized and expressed in England, France and the United States, of entrusting the burden of maintenance in the future to commercial aviation. The report of the American aviation commission, presented to congress in 1919, emphasizes this in a summary of what the commission considers unescapable conclusions, among which are the following:

"That any future war will inevitably open with great aerial activity in advance of combat either upon land or sea, and that victory cannot but incline to that belligerent able first to achieve and later to maintain its supremacy in the air.

"That no sudden creation of aerial equipment to meet a national emergency already at hand is possible. It has been proved within the experience of every nation engaged in the war that two years or more of high-pressure effort has been needed to achieve the quantity production of aircraft, aircraft engines and accessory equipment. The training of personnel, including engineering, production, inspection, maintenance and operating forces —covering some 50 distinct trades and some 75 industries —has proved itself a stupendous task when undertaken upon the basis of war emergency alone."

Dependence Upon Subsidy

At the present time, however, commercial aviation, far from having reached a stage of development in which it would serve as a support to a military air orce, is still in a position of almost absolute dependence upon government aid, extended to a considerable extent with a military purpose in view. The only incentive to commercial development of any kind is the prospect of profits and aviation has not yet reached a stage where this prospect is a powerful stimulant. Traffic is light and costs are still very high, and if the incidental but essential charges of providing fields, meteorological service, etc., were included most commercial companies could not now attempt to operate. Moreover the very nature of air transport, its interstate and international aspect, necessitates a breadth of influence in its controlling power which, at the present time, no commercial company enjoys. So it is that in all countries commercial aviation has shown activity in almost direct proportion to the governmental assistance and encouragement it has received.

The policies of governments in regard to commercial aviation differ widely in different countries. In England until recently the attitude has been that of encouragement and protection by indirect assistance, while direct subsidies were avoided as being detrimental to sound growth. The indirect assistance has been considerable. The military air forces are organized under an air ministry headed by a member of the cabinet, and included

in this organization is a controller-general of civil aviation with supervision over all non-military aerial activity. By this means close cooperation between military and civil organizations is maintained. Landing fields, customs facilities, meteorological reports and other valuable services are placed at the disposal of private companies. Registration and inspection data are provided the insurance companies so that a sound basis for insurance may be developed. It is hoped that eventually many of these services will be taken over by private interests.

The severe slump in air activity in the winter of 1920 and the inability of British air transportaion companies to compete with heavily subsidized French companies led to a modification of governmental policy. For the year 1921-22 for the first time a direct appropriation was granted amounting to £1,000,000 of which £60,000 will be paid as subsidies to commercial companies operating on approved routes on the basis of 25 percent of the total gross revenue earned.

In France the policy of direct assistance has been liberally maintained. Under the direction of an undersecretariate for aviation subsidies are paid to air transport companies based on the type of material employed, its adaptability to military use are the nature, length and regularity of services operated. Subsidies amounting to one-half the purchase price are also granted on the purchase of aircraft constructed after July 1, 1920. The appropriation for these subsidies was increased from 9½ million francs in 1919 to 23 million in 1920 and 32 million in 1921. In 1920 subsidies formed 75 percent of the earnings of air transportation companies.

British criticism of this system takes the view that such liberality maintains machines of any type without sufficient regard to their utility and efficiency and to the value of the work accomplished and even encourages purely military types. Very close supervision is maintained by the government over all aerial activities and subsidies are granted subject to comprehensive restrictions regarding operating details, including passenger and freight rates which have been very much reduced. Insurance is made compulsory and tends toward state control.

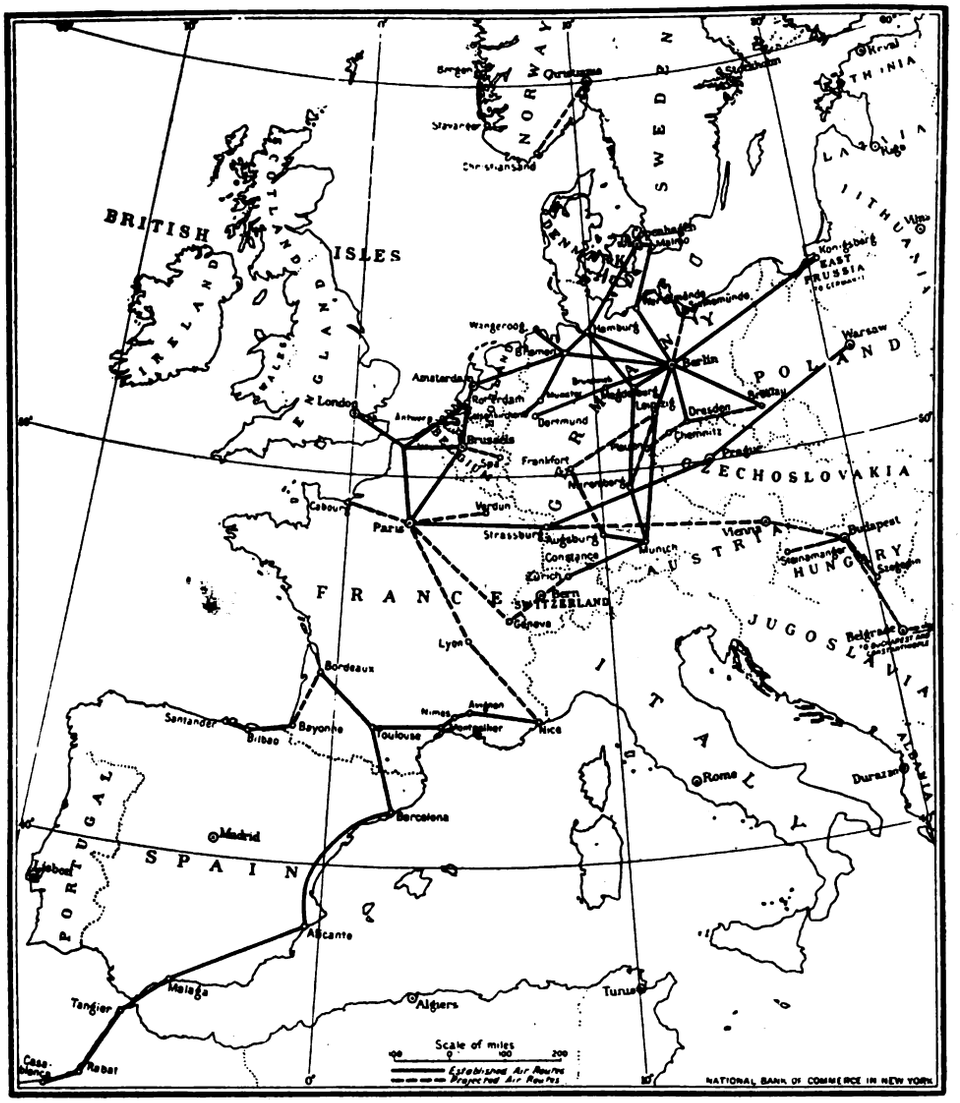


Fig. 1. Map of western Europe showing commercial air routes of importance now in operation.

In several other continental countries direct as well as indirect governmental assistance is extended. The governments of Belgium, Germany, Holland and Rumania grant subsidies of various types to private companies. In other countries notably Italy, government assistance is strongly advocated but has not yet been obtained, with the result that most commercial ventures have failed to materialize.

The present state of commercial aviation abroad is portrayed by the map of western Europe on this page. On this map the heavy lines indicate air routes, either mail, freight or passenger, which are traveled regularly according to schedule by the aircraft of a commercial company. The broken line sindicate routes which are now operated only occasionally or which are under serious consideration and likely to be inaugurated in the near future. Needless to state, there are scores of other routes, not indicated here, which have been and are the subject of much prophecy and promise but of which as yet there has been little progress toward actual operation.

It will be noted that in England there has been no internal development. Due to the short distances to be covered and the excellence of existing means of communication England in itself is not a favorable field. The important routes cross the channel, from London to Paris, to Brussels and to Amsterdam.

The London-Paris route, the most active of any in the world, was served in the fall of 1920 by four British and three French companies, all of which gave daily service with at least one departure from each terminal. At pres-

ent there are two British and two French companies active. The passenger fare of £6 6s. includes transportation by automobile to and from the center of each city to its landing field. With this included the time for the trip averages about 4 hours, a saving of 6 hours over the boat and train route at slightly less than twice the cost. The 223-mile flight takes from 2 to 2½ hours. Passengers are allowed 30 pounds of baggage without charge. Mail is carried for additional postage of 2d. per ounce and freight charges on a sliding scale amount to 9s. per pound on parcels up to 10 lbs. in weight.

On the London-Brussels route but one Belgian company now operates, the British company having abandoned the field. The scheduled time for the trip of 210 mi. is 2½ hr. This service advances all British mail passing through Brussels for interior points by a full day.

The longest of the three routes from London is that to Amsterdam, a trip of 258 mi. Daily departures in both directions were made by two British companies, with Rotterdam an intermediate stop on the homeward trip. A single Dutch company now gives daily service. The scheduled time is 2½ hr. The mail charge is 4½d. per oz. and a single fare £8 8s. This route connects with several continental routes whose terminals are at Amsterdam, and in consequence the Danish and German mails arriving in Amsterdam are sent direct to London by air.

The results of British commercial aviation activity, which consists almost entirely in the operation of the lines mentioned above, are summarized in the following table. The effect of the season on aerial traffic is easily remarked.

British civil aviation:

	May-Sept. 1919 5 mos.	Oct. '19 Mar. '20 6 mos.	Apr.-Sept. 1920 6 mos.	Oct. '20 Mar. '21 6 mos.	May '19 Mar. '21 23 mos.
Number machine flights	31,250	6,571	20,658	5,496	63,975
No. machine hrs. flown	6,566	3,061	8,200	2,626	20,453
Av. duration flights, min.	12	28	24	28	19
Approx. machine mileage	460,300	231,600	689,600	212,200	1,593,700
No. passengers carried.	58,132	9,808	32,345	10,103	110,388
Freight carried, tons ...	20¼	25¾	86½	38	170½

From the time of the inauguraiton of the air service with the continent, Aug., 1918, until the end of March, 1921, there were 2,315 arrivals in England and 2,191 departures. During this period goods to the value of £818,553 (about $4,000,000 at normal exchange) were imported, constisting almost entirely of luxuries from France. Exports totalled about half that amount and were somewhat more evenly distributed among France, Belgium and Holland, with France taking the largest share.

In October, 1920, 14 months after the inauguration of the service, 27,400 letters were sent from London and 23,050 received. The incoming mail from Amsterdam was particularly heavy, including as it did much German and Scandanavian correspondence, and comprised in that month 16,200 letters. Since then the mail traffic has declined as several British companies have ceased operations. However, the volume is still sufficiently large to be of commercial importance.

Paris the French Air Center

French aerial activity centers at Paris, which is a terminal for three routes operating daily—to London, Brussels and Amsterdam, and also for a service to Strassburg, Prague and Warsaw three times a week. The latter is interesting as a part of an ambitious plan to extend the air line eventually to Vienna, Budapest, Belgrade. Bucharest and Constantinople. From Toulouse airplanes leave four times a week for Barcelona, Alicante, Malaga, Rabat and Casablanca, carrying mail, passengers and freight. A stop is made for lunch at Barcelona and at Alicante for the night. This was the first of the commercial routes established in France and has been eminently successful—aided of course by subsidy.

There are in addition a number of short routes in operation in France as indicated on the map, Fig. 1. Most of these are scheduled for three and four times a week. There were in all, at the end of last year, some 15 French companies engaged in aerial transportation on regular routes with a total equipment of about 450 machines.

Although the development of commercial aviation in Germany, particularly in regard to international operations, has been severely handicapped by the terms of the peace treaty there has been remarkable progress in establishing air routes within the country. As indicated on the map the principal cities are interconnected by a network of air lines, most of which are operated regularly. Schedules are so arranged that the interior services connect advantageously with the international routes at Hamburg, Bremen and Berlin. In 21 months of operation the principal commercial company is reported to have carried more than a million pounds of freight, which includes 72.500 pounds of mail, and 5.545 passengers. The German industry has been relieved of a large surplus of military material by the destruction of most of it under the terms of the treaty. In technical skill the German designers hold a high place and some of the most noteworthy technical advances since the war have originated in that country.

The development of commercial aviation in the United States has been along lines different from that in Europe, due partly to the fact that the public has not been familiarized with flying as were the populations of the belligerent European countries and partly to the absence of a definite governmental policy. Commercial transportation companies have received neither assistance nor encouragement and in consequence private enterprises of this nature have accomplished very little. On the other hand the government, in the army, navy and post office departments, has been active in experiments of great value to commercial aviation so that in the United States the one distinctive example of successful aerial transportation on a large scale is not strictly commercial, but is merely civil, as distinct from military aviation.

The United States Air Mail

The air mail was inaugurated on May 15, 1918, after a period of experiment undertaken by the army air service and the post office department. Under the auspices of the latter organization a daily mail service was begun between New York and Washington by which New England mails for Washington and southern mails for New York were considerably advanced. The airplane time of from 2½ to 3 hours for the 218 miles is just half that of the railroad delivery.

The first year's operation of this route was so successful that the original appropriation of $100,000 was repeated and on the first anniversary of the service a route from Chicago to Cleveland was begun. On July 1, 1919, this was supplemented by a New York to Cleveland route which established air mail service between New York and Chicago and advanced the mails in both directions by 16 hours. The airplane has the advantage both of great speed and direct route. The distance by air between New York and Cleveland, for example, is but 410 miles, which

is covered by mail planes in 4½ to 5 hours. By rail the distance is 620 miles and the time of transit from 13 to 17 hours.

Further expansion was permitted by an increased appropriation of $850,500 in the fiscal year 1920. On May 15, 1920, operation was begun between Chicago and Omaha, an air distance of 440 miles, by which mail in both directions was advanced 12 hours. A like saving of time was accomplished between Chicago and St. Louis when this service was begun on Aug. 16, 1920.

After a long period of careful preparation the New York-San Francisco trans-continental air mail route was first operated on Sept. 8, 1920, via Cleveland, Chicago, Omaha, Cheyenne, Salt Lake and Reno. The initial trip demonstrated that 16,000 letters, westbound, could be advanced 22 hours over the best possible time by rail. Later plans were designed either to advance 16,000 letters by 42 hours, in each direction, or to advance four times this bulk of mail by 24 hours. The latter arrnagement was decided upon and is accomplished by utilizing air despatch during the day and rail service at night. Obviously the present impracticability of night flying is an obstacle to further saving of time but experiments in night flying are being made and with even one night flight the mail time between New York and San Francisco can be reduced to 36 hours. As a feeder to the mail trains and the transcontinental route an extension of the air mail between Chicago and Minneapolis was put into operation

For regularity and reliability of service the air mail is unequalled by any other aerial undertaking. In the year ending June 30, 1920, out of a scheduled total of 2,249 trips 1,995 were attempted and 1,828 completed. A total weight of 526,578 pounds of mail was carried, over a total distance of 549,244 miles. The cost of this service, including depreciation at 33⅓ percent and capital charges at 6 percent was $553,156, or approximately one dollar per mile. Despatch by airplane advanced the delivery of more than 23 million letters from 16 to 24 hours at less than it would have cost to transport and distribute them by rail. No additional postage is required as the practice of selling special air mail stamps has been discontinued since 1919.

In addition to the mail routes operated directly by the post office department contracts have been let to private companies for mail carriage between Key West and Havana and between Seattle and Victoria, British Columbia. The private contract appears to be a logical development of the service. At present further expansion in this direction is prevented by the refusal of congress to allow the establishment of air routes, even where great saving of time might be effected, unless the cost is no greater than that by rail. However it is probable that with the increased efficiency which may be reasonably expected of airplane operation in the near future this ruling may no longer be seriously restrictive.

The insufficiency of appropriations for the fiscal year 1922 caused the abandonment before July 1, 1921, of all the directly operated air mail routes except that from New York to San Francisco, for which $1,250,000 has been voted. It is possible that this abandonment will be only temporary and that private enterprise may be able to continue the work of the post office department. The maintenance of the landing fields on these abandoned routes would be of very great value both to the military air services and to commercial aviation.

There is practically no commercial aviation in this country now aside from the air mail, except possibly the one small route between Key West and Havana. It is estimated that there are about 100 air transportation companies in the United States, but regular operation of substantial commercial importance has scarcely begun.

Commercial aviation is laboring under many difficulties. By far the greater part of the material in use is converted war material, built for extraordinary performance rather than economy. This material must in some way be worked off the market before new and better models can profitably be built. Traffic is light and variable and the uncertainty of its future volume and nature is a severe handicap. There are in addition many technical details, both in regard to material and organization, that appear to be of minor character but frequently turn out to be important to economical operation. The greatest handicap by far to further development lies much deeper than present financial prospects of the industry. It is the continued lack of public confidence in the safety and reliability of air transportation.

Since the armistice accidents have been increasing in number in some countries at a higher rate than the increase in flying. The most carefully compiled figures, those for British commercial aviation, show the death rate of passengers to have increased from 0.10 per thousand passengers carried in the six months ending March 31, 1920, to 0.22 in the six months ending Sept. 30, 1920, and to 0.30 in the six months ending March 31, 1921. In the 23 months from May, 1919, to March, 1921, inclusive, 20 persons were killed and 21 injured in a total of 48 accidents or one accident for every 33,200 miles flown. In the United States the number of casualties, both in military and civil flying, has been alarming; although it is not possible to determine the accident rate as no official reports are required either of flights or accidents.

The situation in the United States in this regard is very much worse than in most other countries, where government supervision of civilian flying is practiced. The lack of official regulation of aviation, in some form, is the greatest detriment to increased safety in flying in this country. The present situation in the United States is one of total absence of regulation, with the exception of a very few state laws and municipal ordinances. In most parts of the country there is nothing to prevent any pilot from operating any machine, without regard to his competency or its condition. It may well happen and often does happen that an irresponsible pilot will fly a machine unfit for use, with imminent danger to the life of himself, his passengers, and the safety of the community. In case of accident the entire aircraft industry suffers through the injury to its most vital asset, its reputation with the public.

The operation of airplanes for other than transportation purposes would, if properly regulated and supervised, perform a valuable service to commercial aviation by familiarizing large numbers of people with the advantages of aerial transportation. A system of licensing by which the safety of such flying could be improved cannot be established, however, without the enactment of an air law. That an air law must be at least national in scope is evident from the very nature of aviation and considering the distances already covered by commercial air routes the advantage of a law which is internationally uniform is apparent.

Efforts to establish an American air law have encountered a fierce conflict in regard to the form of the supervising organization and as yet have been without tangible results. It is gradually being realized by all those concerned with the future of American commercial aviation that the need for an air law is so pressing that its method of administration is a secondary consideration. When this attitude becomes general substantial progress may be expected. Wise regulation may be expected to give a certain stability to the air transportation industry essential to any industry which must appeal for credit and for investment capital. Until this is attained air transportation cannot be said to be on a business basis.

Special Motor Cars for Testing Casing Gas

Continued from page 14

pressure cooling coils and into the low-pressure accumulator. The gasoline produced in this stage remains in the bottom of the accumulator, and the gas goes out of the top and into the suction of the high-pressure cylinder. The pressure is now increased to 250 lb. per sq. in. and the gas is discharged or forced through the high-pressure cooling coils into the high-pressure accumulator. Both the low and high-pressure coils are submerged in water, the temperature of which is held at 40 deg. F. by the use of ice. At the top of the high-pressure accumulator is a pressure gauge and relief value to regulate the pressure. We have now traced the gas through the machine.

In beginning the test, after building up the pressure, regulating the temperatures and blowing the accumulators dry, we read the meter and let the gas pass through for the required number of feet to be run. At the end of the test, we reduce the pressure on the accumulators to atmosphere, which is indicated by zero on the gauge, draw off the gasoline, and raise the temperature in an open tube to 60 deg. F. at a rate not to exceed 1 deg. every two min. The gallons per thousand cu. ft. of gas is then determined by computation from the number of cubic feet of gas used and the cubic centimeters of gasoline recovered.

When drawn from the accumulators the gasoline is at a temperature considerably below the freezing point. Bringing it to a temperature of 60 deg., the standard temperature adopted for testing, allows for certain evaporation of volatile fractions up to that point. From this process of weathering arises the designation as a weathered test.

The company is justly proud of the accuracy and utility of the test cars recently designed and completed, and now have in operation. Incidentally, this is an entirely new field opened up for motor vehicles, and a profitable one.

Finish Cylinder Bores by Honing

At the plant of the Oakland Motor Car Co., Pontiac, Mich., the bores of cylinders are sized accurately by honing. In the process the bore is reamed to within a few thousandths of an inch of the desired size while the final finishing is performed in a special machine equipped with abrasive hones, mounted on a reciprocating spindle. The hones are kept in contact with the bore by springs so that they float and position readily instead of being forced unduly against the cylinder wall. It is claimed that the honing process finishes cylinders with a high degree of accuracy.

S. A. E. Aids in Cutting Costs

Simplification is probably one of the most important means of cutting production costs, but it cannot be accomplished by the individual manufacturer without the whole-hearted support of the financial, sales and production executives. To obtain the greatest reduction in cost it is necessary, however, that such simplification be carried beyond the plant of the individual manufacturer until, by cooperative effort, a national simplification is accomplished which will react with tremendous advantage to each manufacturer. Such cooperative simplification, or standardization, between manufacturers is carried out most advantageously by trade organizations.

In the automotive industry the Society of Automotive Engineers, functioning through its standard committee, makes possible this coordination of effort which has resulted in the application of standards and consequently the cutting of production costs to a great extent. Additional standards, each representing a possibility of reduced costs, will be acted upon at the standrads committee meeting on Jan. 10 in New York. Sixteen divisions representing different fields in the automotive industry and part or material manufacturers will present over 30 proposals for adoption as standards. The iron and steel division will submit a complete revision of the present iron and steel specifications which will make possible more intelligent selection of steels for automotive purposes. The report is based on a great number of laboratory tests carried out in metallurgical laboratories throughout the country. Several recommendations applying to passenger-car body parts will be discussed, the recommendations representing the initial effort of the society on body standardization. Parts and materials which are covered in the various reports are as follows: ball bearings, roller chains, sprocket cutters, flexible conduit, generators, insulated cable, starting motors, carbureters, engine numbering system, fan belts and pulleys, mufflers, running-boards, iron and steel specifications, bases, sockets and connectors, lamp glasses, tail lamps, nonferrous metal specifications, rod-ends, lock-washers, door-fit clearances, door handles, body nomenclature, pressure gages, pneumatic tires, tractor drawbars, clutch facings, tire pumps, three-joint propeller-shafts.

Why Lumber Is Steamed During Kiln Drying

The reason for steaming lumber during drying depends on when it is done, but nearly always the treatment is given for one of the following purposes: (1) to heat lumber through quickly at the start; (2) to relieve stresses which otherwise would produce checking, case-hardening, and honeycombing; (3) to equalize the moisture content and condition the lumber ready for use at the end of the run; (4) to kill fungi and insects in the wood.

When lumber should be steamed, how long the treatment should last, and what temperature should be maintained are points which have been determined at the Forest Products Laboratory by experiments on many species of wood. A thorough understanding of the steaming operation is essential, because the whole kiln charge can easily be ruined by too severe a treatment. One of the chief needs of many commercial kilns is proper steaming facilities, without which a high degree of success in the artificial seasoning of wood is impossible.

Consolidating Rural School Through Motor Trucks--III

Interesting Sidelights on the Method of Improving Rural Education of Children by Providing Motor Busses for Transportation—Good Roads—Transportation Costs and Various Methods

Continued from Page 27, October Issue

AS HAS been pointed out in the previous installment, the consolidated school does not cost the taxpayer less, on the contrary it costs more, but in return the farmer and his family get immeasurably more and the increased tax is slight comparatively speaking so that the consolidation plan is distinctly worth while. Transportation is really the vital factor in the plan, for without adequate transportation means the whole plan falls down. Not alone must there be adequate transportation, but it must be regular and reliable. Further it must be so managed as not to cost too much.

Any school consolidation plan is bound to improve the roads; first those radiating from the schools, and then as the benefits of these become apparent on the one hand, and as a road past the school is improved throughout its length and its benefits proven. Good roads and good consolidation schools go hand in hand—one is the inevitable complement of the other. In White River township, Randolph county, Ind., the roads of the entire township are improved, making transportation comparatively easy and rapid. The one-teacher school has been completely supplanted by the consolidated school. More than 18 one-room schools were abandoned and as an improvement there are two splendid large modern two-story combination public and high school buildings.

In the matter of roads, however, consolidation should not wait for improved roads but should forge ahead, as experience has proven that the bigger and better school always brings better roads. As a matter of fact consolidation usually directs public attention to a road situation which would be ignored otherwise, and in this way, forces permanent road improvement. All over Indiana, Minnesota and North Dakota where due to severe winters and the kind of soil, road conditions are not always of the best, transportation is universally giving satisfaction. At Brewster, Minn., where they have two auto busses and four horse hacks, there has been no failure this year (1920) of a bus to arrive. Last year there were, in all, ten lates and four days that the roads were impassable. But what if an occasional day is missed? Do not the children who attend the one-room school have to stay home days and even weeks on account of impassable roads? In the spring of the year when the thaws come and the roads are broken up for about two weeks schools can arrange as many do, to have their spring vacation at that time.

Cost of Transportation

The cost of transportation per child varies somewhat in the different states, due largely to differences in climate, density of population, size of consolidated areas, labor and road conditions.

Very few schools know what their transportation is costing them, except the amount that is paid in salaries to drivers. This, of course, is only a part of the real cost of transportation unless the drivers own all the transportation conveyances and meet all operating expense. In fact, very few schools have been keeping any systematic account of operating expenses. In addition, so many schools have been formed or have adopted motor transportation so recently that the arrangements are somewhat chaotic and are subject to frequent change.

In some districts the winter just passed has led to much experimenting with pneumatic and solid tires. There is no question that the pneumatic tire will give the greater comfort to those riding, insure greater traction in traveling over muddy roads, and on good roads will give the greater mileage; but many country roads are exceedingly poor during certain seasons of the year. Many schools are attempting to carry too big a load with a truck of light tonnage. Very few have any idea what mileage they are going to get from their tires or trucks or what the replacement of parts, repair work and annual overhauling are going to cost.

In most cases where horse transportation is used, the school board owns the wagons but hires the drivers for a fixed wage and the drivers furnish the horses. Such transportation involves four items of expense to the school:

1. Driver's wage.
2. Depreciation on the wagons.
3. Repairs.
4. Interest on the amount invested, to be figured at the prevailing rate which school bonds bear in each community.

Insurance would make a fifth item if the school carries it.

It is difficult to say how long wagons will run. Some of the older consolidations have been able to use their wagons 12 years, while other have been able to get only 8 or 9 years' use. The better grade costs about $400.00. The repairs required from time to time are very slight, being chiefly the retiring of the wheels every 3 or 4 years. In the following estimates depreciation and repairs on school wagons are figured at 10 percent.

Data followed which showed that the cost in the case of Jackson Consolidated School, Randolph county, Ind., with everything properly figured was $0.144 per day per child (285) using 12 horse hacks; in Sioux Valley, Minn., $0.237 per day per child (143) using seven horse hacks; in Jackson Township Central School, Preble county, O., $0.259 per day per child (210) using four auto busses and one horse hack; at Linden, Ind., $0.284 per day per child (90) using four auto busses and one automobile; at Sargent School, Rio Grande county, Col., $0.208 per day per child (390) using 10 motor busses; at Consolidated School, Center, Col., $0.301 per day per child (184) using six motor busses; at Monte Vista Consolidated School, Col., $0.426 per day per child (180) using eight motor

Slightly abstracted from Firestone Ship by Truck bulletin No. 6, entitled Consolidated Rural Schools and the Motor Truck. Cuts kindly loaned by Firestone bureau.

busses; and at McKinley School, Randolph county, Ind., $0.188 per day per child (293) using five township-owned motor busses, three automobiles and one private rig.

From these eight cases in which precise detailed figures are available, and in which cases a total of nearly 1,800 pupils are transported each day (1,775 to be exact), the cost averages approximately 25 cents for each child per day ($0.256).

Suggestions to Reduce Costs

There is a great deal to be hoped for in the future in the working out of several phases of the motor transportation question, such as putting the motor bus to the greatest economic use, selecting competent drivers on satisfactory terms and choosing between school or driver ownership of transportation facilities.

The auto bus should be put to the greatest use in order to secure the most economic results. Many busses are standing idle too much of the time. In many instances they should be given longer routes. In some cases a long and a short route for each bus would make for greater efficiency. If the auto busses could be used during the day for other hauling, while the children are in school, the daily earnings of the bus and the driver might be increased. Many drivers who own their busses have truck bodies and can use them Saturdays and during vacation periods for general trucking business.

To drive an auto bus for the transporting of children to and from school ought not to take more than three hours a day of any driver's time and no driver should look upon a driving job as a full day's work and expect to get remuneration upon that basis. Drivers should be selected with this idea in mind. Of course, the competence of the driver and the quality of the service should not be lost sight of in the attempt to get the driving done cheaply.

In Colorado drivers are selected who have other occupations, but are free at the time when the children have to be transported. Drivers such as teachers, high school boys, bank clerks, and retired farmers have all proved very satisfactory, and usually at a reasonable wage.

In Minnesota transportation may cost a little more than in some of the other states because, as a general rule, boys are not allowed to drive and children are not to be hauled farther than the actual distance from their homes to the school building. The latter rule will not make possible capacity loads in every case. The state inspector of rural schools estimates that the horse-drawn transportation in Minnesota this year, in most of the districts, will cost $ .045 per child mile, one way. A child, then, living six miles from school would entail a cost of 54 cents per day while one living only two miles would cost 18 cents per day.

A number of the consolidated districts have up-to-date garages with complete equipment. At the Sargent School in Colorado they have hired a mechanic for $150 a month, who not only keeps the busses in repair and excellent running order, but teaches the high school boys automobile mechanics and blacksmithing as well. Practically all of the materials, such as gas, oil, tires and repair parts are bought at wholesale and in this way a very appreciable saving made.

While estimating the depreciation on the auto busses in the preceding tables at 20 percent, much depends upon the type of truck used and the miles covered. The majority of busses, however, will probably give 50,000 to 100,000 miles under normal transportation conditions. The average school auto bus will very likely last over five years, but it is better to overestimate the cost than to underestimate it. However, it will probably not give the mileage that busses in other service will since it is used only a small portion of the day and is stored away three months in the summer time.

It is impossible, of course, to recommend any definite truck tonnage or standard of equipment, due to the varying conditions throughout the country. As those who have been close to the transportation question are coming to have more experience in these matters, they seem to favor the trucks of 1½ ton capacity. The lighter weight trucks, carrying 30 or 35 children, are not giving satisfaction. They are all right for short hauls and light loads. The size of the consolidation will determine to a great extent the choice of truck tonnage. Preference is also being shown for the pneumatic tires of truck size.

With regard to comparison of cost of motor transportation with that of horse transportation in the hauling of children to and from school, too much credence should not be placed in any of the current statements. From the foregoing estimates on the cost of transportation in a number of the different consolidated schools, it would seem that some of them have effected a saving by adopting motor transportation, while others have not. It may not be possible to show that motor transportation is cheaper than horse transportation in every instance, but motor transportation is rapidly winning favor throughout the country, on its other merits.

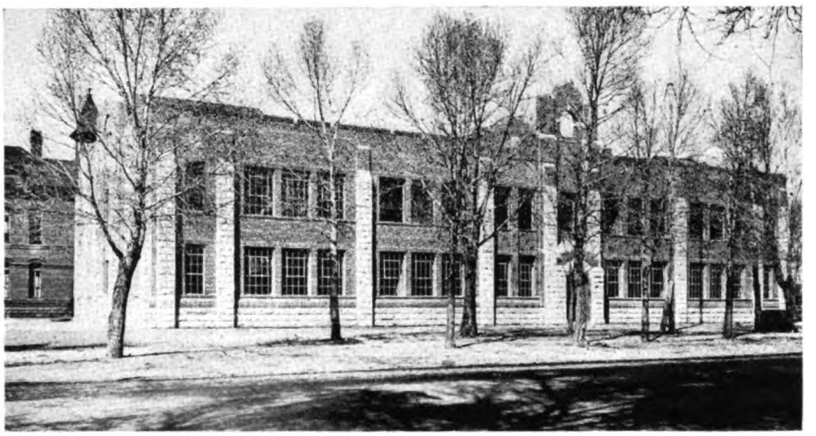


Fig. 12. Splendid new Junior High School building at Monte Vista, Col., which has an enrollment of 800 pupils.

Cost records must be kept to detect waste and suggest future economies, also for the information to taxpayers.

A table is then presented covering 40 schools in eight states. Lack of space prevents reproducing this in full, but the major items from an automotive standpoint are given herewith, and totals or averages (as the case may be) have been added.

Advantages of Motor Transportation

Motor transportation is rapidly coming to be the established method of transporting children to consolidated rural schools. Because of the recency of its adoption throughout the country there is still much that can be done to make motor transportation more efficient.

The school officials of the country are practically unanimous in the belief that motor transportation for the consolidated school is going to displace all other methods within a very short time. Parents are beginning to demand and many school officials are saying that they will invest no more money in horse-drawn vehicles.

School	State	Total Enrollment	Number Transported	Transportation Cost per Child per Day	Number of Routes	Average Distance of Routes mi.	Kind of Conveyances
Waynetown	Ind.	350	191	$.226	11	6	2 motor trucks 9 horse hacks
Bowers	Ind.	121	110	.253	6	6	1 motor truck 5 horse hacks
Linden	Ind.	250	90	.284	5	6	4 motor trucks 1 automobile
McKinley	Ind.	306	293	.188	13	5.5	5 motor trucks 3 automobiles
Lincoln	Ind.	228	220	.242	12	5	4 motor trucks 2 horse hacks 1 automobile
Wayne	Ind.	213	200	.215	11	5.5	11 horse hacks
Wilson	Ind.	103	78	.159	3	6	1 motor truck 1 horse hack
Spartanburg	Ind.	340	300	.262	16	6	4 motor trucks 8 horse hacks 2 automobiles
Losantville	Ind.	201	92	.212	6	5.5	1 motor truck 4 horse hacks
Lynn	Ind.	325	130	.227	9	5	2 motor trucks 2 horse hacks 3 automobiles
Farmland	Ind.	250	74	.275	6	5	4 horse hacks 2 automobiles
Jackson	Ind.	285	285	.144	12	5.5	12 horse hacks
Rollo	Ill.	100	85	Private Transp.	..	3	.....
Orange Twp.	Iowa	230	230	.175	12	4.5	12 horse hacks
Jesup	Iowa	410	175	.285	13	5	13 horse hacks
Hudson	Iowa	172	90	.261	5	6	1 motor truck 4 horse hacks
Fairview	Iowa	105	105	.408	8	5.5	8 horse hacks
Highview	Iowa	120	120	.309	9	..	9 horse hacks
Alta	Iowa	464	220	.358	12	4	2 motor trucks 10 horse hacks
La Jara	Col.	320	125	.317	4	8	3 motor trucks
Monte Vista	Col.	800	180	.426	8	10.5	8 motor trucks
Sargent	Col.	397	390	.208	10	14	10 motor trucks
Center	Col.	409	184	.301	6	18	6 motor trucks
Avondale	Col.	160	60	.127	2	5	2 horse hacks
Pinon	Col.	75	75	.195	3	5	1 motor truck 2 automobiles
Malden	W.Va.	350	141	.083	5	3	1 motor truck
Oak Hil	W.Va.	700	25	.10	1	3.5	1 motor truck
Brewster	Minn.	201	79	.438	6	5	2 motor trucks 4 horse hacks
East Chain	Minn.	212	200	.318	9	4.5	5 motor trucks 4 horse hacks
Sioux Valley	Minn.	143	143	.237	7	5	7 horse hacks
Okabena	Minn.	149	76	.208	4	4	4 horse hacks 4 private rigs
Lanier Twp.	Ohio	300	265	.167	12	6	2 motor trucks 8 horse hacks
Camden	Ohio	400	238	.228	12	4.5	2 motor trucks 10 horse hacks
Eaton	Ohio	750	250	.195	13	5	5 motor trucks 2 horse hacks 2 automobiles
Jefferson	Ohio	415	240	.185	10	6	1 motor truck 9 horse hacks
Jackson	Ohio	244	210	.259	7	9	4 motor trucks 1 horse hack
Caperville	Tenn.	220	140	.098	4	5	2 motor trucks 1 horse hack
Millington	Tenn.	400	150	.155	6	5.5	6 horse hacks
White Haven	Tenn.	260	125	.138	5	4.5	3 motor trucks
Levi	Tenn.	126	93	.153	3	3	3 motor trucks
Total	80	8 11,328	6,477		306	278	86 mt. t'cks 16 autos 172 h'se h'ks 4 priv. rigs
Aver.		283	162	.233	7.8	5.9	
Aver. in Col.		360					

Average maximum distance, 8.0
Average maximum distance (Col.) 14.4 mi.
Total size consolidated area, 1,387 sq. mi.
Average size consolidated area, 37.5 mi.
Average percent of enrollment transported, 57.
Average size consolidated area (Col.), 101.4 sq. mi.

Some of the most outstanding advantages of motor transportation over horse transportation are:

1. There is a great saving in time. Children do not leave home so early in the morning nor return so late at night. In schools where horse-drawn vehicles are used, children often have to leave home as early as 6 A. M. and reach home at a correspondingly late hour.

2. More territory can be covered and longer routes can be established, making the larger and more desirable consolidation possible. Horse-hack routes are limited to five or six miles.

3. Fewer busses are required. The trustee of White River township in Randloph county, Ind., says, "One motor bus does the work of three horse hacks."

4. Children do not come to school worn out in the morning by one or two hours' travel on the road, as is the case with horse transportation. The motor bus can make 12 miles per hour, including stops.

5. While the initial cost of an auto bus greatly exceeds that of a horse-drawn vehicle, its operating expense usually is less if efficiently managed.

6. Children are not subjected to the elements of the weather in winter to any appreciable extent. They are not on the road so long, and heating the auto bus by the exhaust from the engine has proved very practicable.

7. The service is much better in that the motor bus affords the maximum of comfort.

8. Children like to ride to school in the auto bus. They are more contented and in a better mental condition upon arrival at school.

9. Motor transportation is more economic in that drivers can more easily follow some other occupation. Little time is spent in driving the auto bus, while horse-hack drivers feel that driving in itself is a day's work and charge accordingly.

10. A nine-month school term can more easily be maintained. Farmers do not like to drive or furnish horses, except during the months from October to March, inclusive, when farm work is slack.

11. It is easier to get drivers since the owning of a team is no longer a prerequisite.

12. Salaries paid for driving are less. The work is more desirable and usually attracts a better type of men. Horse-hack drivers frequently "hold up" schools in the matter of salaries.

13. Daily attendance is more regular.

14. Children do not have to walk so far to meet the school bus because, with few exceptions, it is practicable to have the bus pass every farmhouse.

Conclusions and Summarization

From what has been stated, these conclusions are drawn:

Every state should provide state aid for consolidated schools. This will give a greater equalization of taxes as well as educational opportunities.

The consolidated school should be very decidedly a rural school and should be built in the open country or on the edge of the village.

Every village or small town located in a farming section of the country ought to consolidate with the surrounding territory within a radius of four or five miles. By joining their efforts, both the village and farming community can have a better school with the same expenditure of funds. The course of study can be planned to meet the needs of both village and country, care being taken not to educate away from the farm.

Many consolidated school buildings are too small. The consolidated school grows rapidly, so the buildings should be made larger than conditions at first would seem to require.

The consolidated area should be made large enough so that the school tax will not be excessive. The larger consolidation, ranging from 40 to 60 square miles, is proving to be the more satisfactory.

The school should embrace a complete four-year high school course. Every country boy and girl should be given a high-school education within easy reach of their homes.

Consolidated schools are more than mere school buildings. They should become, in every sense of the term, community centers. The farmers of the consolidated district should be made to feel that the school building is theirs for any purpose they wish to use it.

A law should be passed in each state, similar to that existing in Nebraska, which provides for the mapping out of the whole state into consolidated districts.

Consolidation is helping to solve the teacher shortage in that fewer teachers are required than with the one-room system. It is easier to attract good teachers to a consolidated school.

The community should recognize the value of the teacher as a factor in permanent community life by erecting modern homes for both teachers and superintendent on or near the school campus.

There is a great need at the present time for the right kind of men as community leaders to become principals and superintendents of the consolidated schools. Provision should be made at our normal schools and colleges for the training of these leaders. The leaders of the future are undoubtedly the boys and girls being trained in the consolidated schools.

Too many districts at the time of consolidating do not vote enough bonds. This places them under a permanent handicap.

The most satisfactory type of consolidated school is planned to give the rural community just the kind of education required by an agricultural population. It should not be so practical, however, that it loses all that is cultural, but should fit the boys and girls for a happy and remunerative life in the country.

Those contemplating consolidation should study the experience of other consolidated districts.

The state laws on consolidation should be so revised as to permit districts voting on consolidation to count the votes as a whole, a majority of all deciding the issue. One small district should not be allowed to defeat consolidation.

Rigid rules should be laid down relating to transportation. This problem should have the constant direction of a competent and wide-awake superintendent.

Transportation should be furnished by public conveyance and all children should be hauled in busses owned by the district.

No child should be made to ride in a bus over an hour.

Districts should be rerouted as changes occur in the number and location of children. Many miles of hauling are saved by a careful study of routing.

Drivers should be required to sign a contract and to give a bond. Contracts should not be let solely on a basis of competitive bidding, as this method does not insure the best results. Character and quality of service are also important factors.

It is a good policy to insure the school and the drivers against all possible accidents, securing protection against losses to the trucks and against damage to life.

At the time of consolidating a number of one-room schools, provision should be made for the raising of sufficient money to purchase all transportation equipment. Increase the bond issue, if necessary, so that the entire initial cost can be met.

There are many reasons why a large part of the cost of transporting children to and from school should be assumed by the federal or state government, if not by both. Since farmers must live at a distance from good schools in order to pursue the occupation of agriculture, the state and federal governments should provide the same educational advantages for rural children that city children get, at least to the extent of free transportation to and from the consolidated schools.

In the United States approximately 2,000,000 children, living in 65,000 old rural school districts scattered in communities from Maine to California and from Minnesota to the Gulf, are now transported successfully to 13,000 consolidated schools.

Many of the problems and difficulties of transportation are now being solved by the motor bus. No longer must routes be limited to six miles, nor are children required to ride as much as two hours to reach school as is frequently the case when horse-drawn vehicles are used. The motor bus will permit the formation of larger districts and larger districts should mean more and better consolidated schools. These in turn should make for better rural communities and a better rural citizenry.

Fig. 13. The eight motor busses which transport the children of the Monte Vista school shown in Fig. 12.

New Tire Guarantee

The members of the tire division of the Rubber Association are about to place a new standard guaranty before the tire dealers. It reads as follows:

"We do not guarantee automobile tires for any specific mileage, but every pneumatic automobile tire bearing our name and serial number is warranted by us to be free from defects in workmanship or material.

"Tires claimed to be defective will be received only when all transportation charges are prepaid and when accompanied by this company's claim form duly filled out and signed by owners. If upon examination it is our judgment that the direct cause of the failure of the tire to render satisfactory service is attributable to faulty material or workmanship, we will, at our option, either repair the tire or replace it for a charge which will compensate for the service rendered by the returned tire, based upon its general appearance and condition."

Exports of motor cars and trucks to Mexico first eight months of 1921 were 237 percent of same period last year.

Automobile Body Builders to Stage Show

Many of those high in authority in the influential circles in the automobile industry are commending the action of the Automobile Body Builders Association in giving a show. This big trade show, national in scope, will be held in the Twelfth Regiment Armory at Columbus Ave. between Sixty-first and Sixty-second Sts., New York, Jan. 9-14, 1922. This location was selected because it is in the heart of the New York automobile district.

Although the show will run concurrently with the national automobile show, each show will have its distinctive appeal and class of exhibits, while taken together they will serve to draw to New York during the January automobile week every class of buyer and seller, and, in fact, every person interested in any phase of the automobile industry.

Prior to September of last year, the body building division of the automobile industry has not made any attempt to place itself in its indicated important position with respect to the other interests in the industry. When it is considered that in a closed car the body is usually more than half its total cost the financial importance of this division is apparent.

One of the purposes of this trade show is to visualize the economic importance of the body builders as a group; another is to stimulate trade and make it easier for the manufacturers of automobiles to draw up practical specifications, and the body engineers and designers to adopt the most advanced and best ideas in construction, trimming and finishing of bodies.

Perhaps one of the outstanding features of the show will be the matter of making or maintaining acquaintanceship, for the show will bring together the men who build the cars, those who build the bodies and the owners or representatives of the industrial plants that furnish materials to body builders. Personal contact with the man or men with whom one has had years of association through the medium of correspondence but whom one has never seen is an asset of incalculable value.

The exhibits will be confined to commercial and passenger car bodies and to the materials and parts that are used in fabricating them. Bodies of every type will be shown. Some will be finished and trimmed, others will be in the white, making possible an examination of framing, metaling and other constructive features. What the public and what the manufacturers of chassis and purchasers of bodies are really interested in is seeing construction.

The largest manufacturer in the world of light commercial bodies has bought six spaces on the main floor, equaling 1,200 sq. ft.; in this he will demonstrate the feasibility of his plan of shipping commercial car bodies in sections. Four men will be constantly on hand to show how quickly and easily the entire body can be assembled and taken apart and how quickly and easily an old panel can be taken out and a new one put in its place. These features of demonstration will apply to many of the exhibits. The show will be unique in this respect and certainly educational.

It will be seen, therefore, that under one roof and at one time, there will be found an advanced showing of new, meritorious and standard styles of commercial and passenger car bodies in such condition as will make comparison sure and easy. The entire central part of the main floor which is 200x200 ft., will be occupied with car body exhibits. The spaces along the walls on three sides have been divided into booths 10 ft. square for the exhibition of materials, parts and the products entering into the fabrication of both commercial and passenger car bodies.

The booths in the balcony which are all of a uniform depth of 7 ft. 6 in., have a varying frontage of from 7 to 10 ft. In these will be smaller exhibits; they will be especially attractive because in them will be found many new and unique products.

The show is intended to appeal to the automobile manufacturers, the body engineers and designers, the executives from the body builders' plants, the custom body builders, the dealers and exporters, the trimmers and painters, and the present or prospective car owners who wish to prove to themselves the comparative values of the different makes and styles of car bodies, and who will want to note by sample and explanation the merits of the fabrics, leathers, paints, varnishes, body hardware and the one hundred and one other details that go to make up a body.

There will be about 30,000 sq. ft. of space. The scheme of decoration will be practical and simple—a suitable background for the exhibits. The entire floor will be of a rich green color. There will be no railings in front of or between the exhibits on the central part of the main floor; a background for each exhibit will be formed with green trellis work. The booths around the wall and in the gallery will be divided by appropriate railings or counters. The entire ceiling of the hall will be draped in a sky-blue canopy effect. Trellis work will extend around the entire front of the balcony and will partially hide it from the main floor, but the signs of the exhibitors will be lettered on both sides in such a size as to make them readable from the main floor. Refinement will be lent to the massed colors through the use of festoons of smilax, clusters of flowers, and green plants.

Of the many interesting and educational features, there will be an exhibit of car designs, new and original, which will visualize how art may best be applied in the designing of bodies. A prize of $500 will be awarded to the best design made in accordance with the specifications which are to be drawn up by a committee of body engineers, designers and builders.

This show is not an experiment at all, it is just a sane expression of the desire of men in the industry, buyer and seller alike, to get together and advance their business interests.

The association's show committee is: E. J. Thompson, chairman, E. J. Thompson Co., Pittsburgh; E. J. Bartlett, Baker R & L Co., Cleveland; H. H. Buggie, Dura Mechanical Hardware Co., Inc., Toledo; James R. Fitzpatrick, Haskelite Mfg. Corp., Chicago; John Graham, Holbrook Co., Hudson, N. Y.; A. R. Guider, Erdman-Guider Co., Detroit; William Hatton, Eagle-Ottawa Leather Co., Grand Haven, Mich.; R. P. Henderson, Martin-Parry Corp., Indianapolis; W. R. Laidlaw, Laidlaw Co., New York; Elmer J. Lang, Lang Body Co., Cleveland; Herman H. Lind, Ohio Body & Blower Co., Cleveland; A. L. Phillips, Valentine & Co., New York; W. H. Ritter, English & Mersick Co., New Haven; H. H. Seaman, Seaman Body Corp., Milwaukee; H. A. Singer, Arkla Lumber & Mfg. Co., St. Louis, Mo.; F. D. Suydam, Jr., Milburn Wagon Co., Toledo; E. C. Waldvogel, Yale & Towne Mfg. Co., Stamford, Conn.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Stoughton Wagon Co., Stoughton, Wis., sustained an estimated loss of $225,000 by fire on Nov. 14 when an old factory building was almost totally destroyed, together with 20 completed trucks, as many in process, and considerable material. Most of the equipment was ruined. The wagon department and other buildings were saved. The concern intended to erect a new motor truck factory department during 1922 and will now advance the project. In the meantime the truck processes will be carried on in parts of the wagon and sleigh shops. F. J. Vea is president and general manager and also head of the Great Lakes Malleable Co., 715 Clinton St., Milwaukee.

Rolls-Royce of Am., Inc., Springfield, Mass., is confining its activities to assembling, exclusively. The number of men employed in assembling is below normal and finished cars are being turned out at 25 percent of the plant's capacity, inasmuch as employees are working only part of each week. The company's business was good up until July. In August and September it practically was at a standstill, but there was a decided improvement in October, which, if continued, will necessitate a resumption of manufacturing departments within the near future. The company recently reduced wages.

Durant Motors Corp. has placed with the Continental Motors Corp. of Detroit and Muskegon, Mich., an order for 50,000 to 100,000 automobile engines and parts, involving the expenditure of from $12,000,000 to $15,000,000. The Muskegon plant of the Continental company, where the order will be filled, will increase its working force from approximately 1,300 to more than 3,000 by next spring.

E. W. Bliss Co. has moved its Cleveland plant from Hamilton Ave. to its new location on St. Clair Ave. and the New York Central Railroad at Bliss Rd. On this site the company has erected a machine shop 125 x 350 ft. Later it plans to erect a forge shop. For the present it will discontinue the manufacture of forgings in Cleveland, buying these in the market to meet its requirements.

Durant Motors Co., Oakland, Cal., has awarded contract to the P. J. Walker Co., Monadnock Bldg., San Francisco, for its plant at the end of E. 14th St. It will be two stories, of reinforced concrete, with four wings, totaling over all 800 x 800 ft., and is estimated to cost about $750,000, including machinery. Hunter & Hudson, Rialto Bldg., San Francisco, are engineers.

Winther Motors, Inc., Kenosha, Wis., a recent consolidation of the Winther Motor Co., Marwin Truck Corp. and Kenosha Wheel & Axle Co., is erecting a one-story addition, 62 x 386 ft., with sawfoot roof, as the first of a series of extensions of the main factory. Details of future additions have not been divulged. Martin P. Winther is president and general manager.

Kimball Motor Truck Mfg. Co., Long Beach, Cal., has established temporary offices in the Jones Bldg., 1261 American Ave., for the preparation of plans and specifications for its new works on the West Anaheim Blvd., where four acres has been acquired. Three buildings will be erected, the first unit, 660 x 300 ft. M. O. C. Hull, vice-president, is in charge.

Oshkosh Tractor Co., Oshkosh, Wis., expects to award contracts at once for the superstructure of its new factory, 152 x 380 ft., one story, with sawtooth roof and steel sidewall and monitor sash. Foundations have been completed. The architects are Auler & Jensen, Oshkosh. The plant will cost about $175,000, including equipment. A. D. Paine is president.

Leafless Spring Co., Grand Rapids, Mich., was organized to market the Leafless auto spring which is entirely new, for Ford cars. The spring is to be manufactured in the plant of the Lyons Machine & Tool Co., Muskegon, Mich. Drop forgings and castings will be purchased outside, but all machine work and assembling will be done by the Lyons company.

Sparks-Withington Co., Jackson, Mich., has perfected an adjustable bracket that will permit the use of the standard Sparks-Withington motor horns and equipment on any of 100 types of cars. The bracket is made to be attached to a cylinder head. This bracket will be put in production as soon as arrangements for so doing can be completed.

Seiberling Rubber Co. with a capital of $55,000,000 has been chartered in Delaware. The principal figure in the company will be F. A. Seiberling, former president of the Goodyear Tire & Rubber Co., who is now building up a chain of small tire plants. The Delaware company will act as a holding corporation for these various enterprises.

Glenwood Motor Co., Cleveland, has acquired a site in Findlay, O., for an automobile plant. It has developed a car under the name of the Glenwood Engineering Co., Euclid Ave. and E. 71st St., Cleveland. The proposed plant will provide 90,000 sq. ft. of floor space and will be used for assembling purposes. B. J. Cline is president.

Paige-Detroit Motor Car Co., Detroit, announces that Paige dealers will be able to offer a car in the light car field early in 1922. It is stated that plans are so far advanced that the new car can be shown at the New York and Chicago shows although no information has been made public as to specifications or price.

Dearborn Truck Co., Maplewood Ave. and 35th St., Chicago, has sold its property, including a three-story plant, 110 x 118 ft., to Candy & Co., manufacturers of insulating materials. The Dearborn company is now negotiating for a building more suitable for its manufacturing requirements.

Gary Motor Truck Corp., of Canada, Ltd., Toronto, Ont., has been incorporated at $4,500,000, by Arthur W. Holmstead, Arthur B. Mortimer, William Skelly and others as provisional directors. The company has secured premises on Pacific Ave., Toronto, and is preparing to establish a plant there.

Durant Motor Co., of Canada, Ltd., has been incorporated with a capital stock of $2,000,000 by Wm. C. Durant, Deal, N. J.; Charles F. Day, Bronxville, N. Y.; Henry F. Herbermann of New York and others of Toronto, to manufacture and sell automobile, trucks, motor cars, etc.

Ford Motor Co., Detroit, has preliminary plans under way for a number of additions to its plant. The work, it is said, will be carried out primarily to relieve the present unemployment situation in this section. Bids are being taken for an immediate extension to cost $200,000.

Anderson Piston Co., Bowling Green, O., has purchased the plant formerly occupied by the Vim Motor Mfg. Co., Sandusky, and will shortly move to that site. The company has a capital stock of $500,000. H. H. Elwood is president and C. C. Anderson is manager.

Willys-Overland Co.'s aluminum foundry is to be moved from the Toledo plant of the company and located at Pontiac, Mich. In that city, of course, it will be established at the plant of the Wilson Foundry & Machine Co., which is allied with the Willys interests.

Gray Motor Corp., Detroit, recently organized by Frank L Klingenschmidt, formerly vice-president Ford Motor Co., is perfecting details for the establishment of a local

plant for the manufacture of automobiles, to sell at about $500. Mr. Klingenschmidt is president.

Associated Motor Industries, Inc., recently organized as a merger of a number of automobile companies, will take over the property of the Jackson Motors Corp., Jackson Mich., for $1,105,000. The plant will be operated as one of the units of the consolidation.

Hampden Motor Truck Corp., Holyoke, Mass., a $1,000,000 company granted a charter about a month ago, has purchased eight acres on McKinstry Ave., Chicopee, Mass., on which it will erect the first unit of a manufacturing plant in the near future.

New Process Gear Corp., 500 Plum St., Syracuse, N. Y., a subsidiary of the Willys-Overland Co., Toledo, O., has taken an order for the manufacture of a large quantity of differential gears for the Durant Motors, Inc., 1819 Broadway, New York.

Brockway Motor Truck Co., Cortland, N. Y., has awarded a contract to the Edward J. Beard Building Co., 307 Sherman St., Albany, N. Y., for the erection of a one-story service and repair building, 50 x 100 ft., at Albany, to cost $30,000.

Penn Motor Corp., 1714 N. Broad St., Philadelphia, Hilton W. Scofield, head, will soon take bids for a one-story automobile manufacturing plant at Pleasantville, N. J., 50 x 330 ft. Charles H. Donehower, Pleasantville, is architect and engineer.

W. P. Moran Co., 511 Central Bldg., Los Angeles, Cal., architect, has plans for a one-story automobile assembling plant at Vernon, near Los Angeles, 70 x 250 ft., to cost $75,000. The equipment will include a 70-ft. electric traveling crane.

Durant Motor Co. will start quantity production at the Lansing plant on Dec. 20. It is proposed to turn out 4,000 cars by March 1. The work of equipping the plant is being hurried to have everything in readiness by Dec. 20.

Shaw Brothers Motor Car Co., a recently organized Detroit concern, will soon announce a four-cylinder motor car in the $700-$800 class. It is expected that this company will soon get into production.

Earl Motors, Inc., has filed notice of increase in capital from $21,500,000 to $41,500,000, to provide for expansion. A bond issue of $5,000,000 is being arranged for plant enlargements, new machinery, etc.

Golden West Motor Truck Co., Sacramento, Cal., manufacturer of four-wheel drive motor trucks and parts, is perfecting plans for new works at Richmond, Cal. S. Michelson is president.

Bush Mfg. Co., Hartford, Conn., radiators for trucks, tractors and airplanes, has purchased land and buildings on Wellington Ave., that city. Col. Richard J. Goodman is president.

Motor Wheel Corp., Lansing, Mich., has awarded contract to the H. G. Christman Co., Lansing, for a new one-story and basement factory, 120 x 240 ft. C. C. Carlton is secretary.

The Wilcox Trux, Inc., Minneapolis, has acquired the interest of F. E. Satterlee as receiver of the H. E. Wilcox Motor Co., by purchase of the assets of the receivership.

General Motors Corp., Detroit, is arranging for the discontinuance of its Scripps-Booth passenger car division. It has been producing about 20 cars per day.

Dusenberg Automobile & Motors Co., Indianapolis, operating a local plant for the manufacture of automobile motors, has been incorporated at $5,000,000.

Ajax Battery Co., Canaseraga, N. Y., storage batteries for automobile and other service, is perfecting plans for a plant unit, to cost $50,000.

Chevrolet Motor Car Co., Flint, Mich., has ordered 600 starters per day for an indefinite period from the Electric Auto-Lite Co., Toledo, O.

duPont Motors Co., Wilmington, Del., will erect a new one-story building, 75 x 100 ft., at its plant on 13th Ave., Prospect Park, Pa.

S. H. Vehicle Co., E. 65th St. and Morgan Ave., Cleveland, has started the erection of a three-story factory, 90 x 200 ft.

Kalamazoo Motors Corp., Kalamazoo, Mich., has increased its capitalization from $250,000 to $1,000,000.

Body Builders

Moline Body Corp., Moline, Ill., has added painting and trimming to the company's regular line of activities. That the company will start off in this new field with plenty of work assured is intimated in the report that it has closed a contract with the R & V Motor Co. in accordance with which all bodies for R & V cars will be painted and upholstered in the plant of the Moline Body Corp. To take care of this work the entire third and fourth floors of the company's plant have been newly equipped.

Martin-Parry Co., 560 Jackson Ave., Long Island City, manufacturer of automobile bodies, with headquarters at York, Pa., has had plans prepared for extension and improvements in the building at Lincoln Highway and the Passaic river, Kearny, N. J., recently leased for a new branch plant, to cost about $50,000. The factory will be two stories, 50 x 100 ft.

Autobody Co., Lansing Mich., is another Michigan concern which will benefit greatly by the advent of Durant motors, having the order for all open car bodies, involving several million dollars. This company will increase its working force probably by at least 500 men, very shortly and it is said will soon be in the market for additional equipment.

Mifflinburg Body Co., Mifflinburg, Pa., manufacturer of automobile bodies, has awarded contract to Jacob Gehron & Son, 607 Cemetery St., Williamsport, Pa., for a new two-story plant, 62 x 90 ft. J. C. Sterling heads the company. R. R. Markley, Spooner Bldg., Harrisburg, Pa., is architect.

Southern California Body Co., Long Beach, Cal., has leased the plant of the California Wood Products Co., 1241-49 First St., for the manufacture of automobile bodies, washing machines and similar specialties. Later it contemplates the construction of a new plant.

Fisher Body Corp., Durant Bldg., Detroit, manufacturer of automobile bodies, will break ground at once for a new two-story machine shop, 30 x 50 ft., on Farnsworth Ave., to cost about $30,000. Austin & Howe, Book Bldg., are contractors. Fred J. Fisher is president.

Randolph Wagon Works, Randolph, Wis., has let the general contract to the Hutter Construction Co., Fond du Lac, Wis., for erecting a new two-story factory, 100 x 200 ft., estimated to cost $65,000.

Ford Motor Co. will build a 60 ft. addition to its body plant at Iron Mountain, Mich.

Pernambuco to Hold Auto Exhibit

The Automobile Club of Pernambuco is planning to hold an automobile exhibit in connection with the Pernambuco participation in the Brazilian centenary celebration which will take place in the spring of 1922. The agents of the different cars sold in Pernambuco will be requested to furnish exhibition cars, and it is expected that the manufacturers will be asked to furnish these cars on terms especially favorable to the local agents on whom the expense of this exhibit will fall. Consul Cameron advises that American manufacturers consider this invitation, for the reason that Pernambuco's automobile purchases have been increasing rapidly during recent years, and it is the manufacturers who will reap the benefit of the exhibit.

The automobile industry paid in 1920 in federal taxes the sum of $148,720,800.

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are What They Are What They Are Doing

C. R. Cunliffe, for more than 10 years associated with the Cadillac organization, has resigned from the general managership of the Chicago branch of the Cadillac Motor Car Co. to become associated in an executive capacity with R. H. Collins, former Cadillac president and now president and general manager of the Peerless Motor Car Co. of Cleveland.

Benjamin Briscoe, who recently severed his connection with Briscoe Motors, Jackson, Mich., has organized and incorporated an automotive engineering company to do business in Detroit, with offices in the Book Bldg. Capital stock is $205,000, and $100 shares of common stock. The company is known as the Briscoe & Stahl Co.

Clement O. Miniger, vice president of the Willys Corp., as well as president and general manager of the Electric Auto-Lite Corp., will sever his connection with the Willys organization some time between now and Jan. 1 to become associated with W. C. Durant in the management of Durant Motors, Inc.

F. E. Badger has been promoted to sales manager of the chassis spring division of the Detroit Steel Products Co., Detroit. For the last 10 months he was a member of the sales engineering staff and for eight years previously he was plant manager of the Standard Parts Co., Flint, Mich.

D. McCall White, vice president and chief designing engineer of the Lafayette Motors Co., Indianapolis, has resigned and will soon make a connection with one of the largest automobile companies. Mr. White was formerly chief engineer of the Cadillac Motor Car Co., Detroit.

Robert I. Miner has been appointed sales engineer in the pressed steel division of the Motor Wheel Corp., Lansing. His activities will be devoted principally to handling the sales to car manufacturers of the Gier pressed steel plant of the corporation.

L. W. Coppock, production manager of the Kalamazoo Motors Corp., has organized the Kalamazoo Tire & Rubber Co., Kalamazoo, Mich., which has taken over a portion of the building in that city formerly occupied by the Kalamazoo Steel Goods Co.

W. J. Drumpelmann, assistant sales manager Hudson Motor Car Co., Detroit, has resigned to become assistant sales manager of the newly organized Rickenbacker Motor Co. Mr. Drumpelmann has been with the Hudson company since 1917.

Edward A. Hart, recently identified with the Willys-Overland interests, has joined the organization of Charles P. Warren, president of Nash distributing corporations in New York city and Buffalo, N. Y.

O. E. Hunt has joined the Chevrolet Motor Co. as chief engineer. He will have charge of all engineering in the Chevrolet plants. Hunt formerly was with the Packard, Mercer and Hare's Motors.

Leland F. Goodspeed, formerly chief engineer Barley Motor Car Co., Kalamazoo, Mich., has joined the Commonwealth Motors Co., Joliet, Ill., as vice president in charge of engineering.

R. E. Chamberlain, long associated with the Packard Motor Car Co. in various sales activities has been advanced to general sales manager of that organization.

N. E. Ranny, purchasing agent for Winton, Cleveland, has resigned. His successor has not been named.

Harry B. Harper has been appointed sales manager of the Studebaker Corp., South Bend, Ind.

H. R. Viot has resigned as purchasing agent of the Continental Motors Corp., Detroit. He was formerly with the Oakland Motor Car Co., Pontiac, Mich.

C. A. Blake, who for some time has been superintendent of the Stearns factory, Cleveland, has been appointed in a similar capacity at the Winton plant.

J. W. MacMorris has become factory manager of the Mercer Motors Co., Trenton, N. J.

Magazine Learns of 263,900 Car Buyers

263,900 new automobiles will be bought by readers of the Literary Digest, according to a survey of the magazine subscription list. Thirty-seven percent of these will be persons who did not own a car in 1920. Boston gives promise of leading the list of buyers with Chicago in line for second honors.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, of THE AUTOMOTIVE MANUFACTURER, published monthly at New York, N. Y., for October 1, 1921.

State of New York,
County of New York, ss.

Before me, a Notary Public in and for the state and county aforesaid, personally appeared G. A. Tanner, who, having been duly sworn according to law, deposes and says that he is the Business Manager of The Automotive Manufacturer, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are:
Publisher: Trade News Publishing Co., 153 Waverly Place, New York City.
Editor: Morris A. Hall, 153 Waverly Place, New York City.
Managing Editor: Morris A. Hall, 153 Waverly Place, New York City.
Business Managers. G. A. Tanner, 153 Waverly Place, New York City.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)
Trade News Publishing Co., 153 Waverly Place, New York City.
G. A. Tanner, 153 Waverly Place, New York City.
Paul Morse Richards, 153 Waverly Place, New York City.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

G. A. TANNER, Business Manager.

Sworn to and subscribed before me this 30th day of September, 1921.

(SEAL) JOSEPH R. FRITH,
Notary Public, Kings County, No. 79.
Certificate filed in New York County, No. 182.
Kings County Register's No. 2078.
New York County Register's No. 2163.
Commission expires March 30, 1922.

FOREIGN MANUFACTURING INQUIRIES

The following inquiries, offering manufacturing and merchandising opportunities, have been received recently and are offered to subscribers and friends of Automotive Manufacturer for what they are worth

31—An engineer in Norway desires to secure an agency for the sale of motor boats and marine engines for fishing and pleasure, motorcycles, motor tractors, and automobiles. Quotations should be given f. o. b. New York. Terms: Payment against documents in New York. Reference.

40—A commercal agency firm in Norway desires to purchase and secure an agency for the sale of motorcycles and accessories. Quotations should be given c. i. f. Norwegian port. Reference.

47—An American exporting firm having connections with importers in North Borneo desires to secure an agency for the sale of steam engines, portable one-man saws, light motor trucks, trailers, nails, second hand bicycles, and motor boat engines of 12 to 45 horsepower. Quotations should be given f. o. b. New York. References.

48—A commercial agent in the Netherlands desires to secure an agency for the sale of machinery, motors, rubber goods, rubber tires, etc. Quotations should be given c. i. f. Rotterdam or Amsterdam. References.

53—A firm of automobile dealers in Spain desires to purchase and secure an agency for the sale of gasoline, air, and oil pumps for use in garages. Quotations should be given c. i. f. Spanish port, or f. o. b. New York. Payment to be made against documents at Spanish port, or in New York. References.

58—A merchant in Chile desires to purchase electrical goods and motors, automobile accessories, phonograph records, electric lamps and supplies and parts, and electric light bulbs of 220 and 110 volts. Quotations should be given c. i. f. Talcahuano. Correspondence should be in Spanish. References.

70—A planter in Angola Southwest Africa, desires to purchase one or two trucks. Quotations should be given c. i. f. Novo Redondo, or Benguela Velha. Correspondence should be in Portuguese.

72—The partner in a mercantile firm in South Africa is in the United States and desires to secure an agency for the sale of automobile sundries and novelties.

74—A manufacturer in Chile desires to purchase supplies and articles of all kinds for carriage and ox-cart manufacturing, such as steel axles or hubs, springs, paints and varnishes, and wheels. Quotations should be given c. i. f. Talcahuano. Correspondence should be in Spanish. Reference.

92—An importing company in India desires to secure an agency and purchase agricultural farm tractors and other mechanical farm implements, motor cars, motorcycles, bicycles and their accessories, rubber goods, such as tires, tubes, hose, and pipes; petroleum products, such as gasoline, lubricating oils, and greases; and workshop requirements, such as oil, engines, lathes, electrical appliances, lamps, and tools. Quotations should be given c. i. f. Cochin, Alleppey, or Tuticorin.

98—A commercial agency firm in Cuba desires to secure the exclusive representation of firms for the sale of the cheaper-priced automobiles. No reference offered.

128—A business man in Spain desires to get into touch with manufacturers and exporters of aeroplanes and motor boats. Catalogues and price lists should be forwarded as soon as possible.

122—A firm in Victoria, Australia, which has taken up the manufacture of light tractors and motor trucks, wishes to be placed in communication with firms for the purchase of suitable engines and transmissions. Prices and full particulars are requested. No reference given.

131—A business man in Canada desires to be placed in communication with wholesale dealers in bicycles and accessories, with a view to securing a large trade in those articles.

132—A commercial agent in Cuba desires to secure the representation of firms for the sale of oils, automobile accessories, and general merchandise. Reference.

172—A retail merchant in Chile desires to purchase hardware, earthenware, machinery, automobiles, dry goods, groceries, and shoes. Quotations should be given c. i. f. Talcahuano or Corral. Correspondence should be in Spanish or German. Reference.

201—The English representative of the Union of South Africa desires to secure catalogues of motor tractors suitable for use in that country.

224—A commercial agent in Bulgaria desires to secure an agency for the sale of rubber goods of all kinds; leather and leather goods and automobiles, motor cycles, and trucks; agricultural machinery. Quotations should be given c. i. f. Bulgarian ports or Constantinople. References.

279—A merchant in France desires to secure an agency for the sale of agricultural machinery and automobiles. Quotations should be given c. i. f. French port. Correspondence should be in French. References.

261—A manufacturing company in England desires to purchase a machine for making motor-car radiator tubes. Quotations should be given c. i. f. English port. Terms: Cash on receipt of machine. Reference.

276—An agency is desired by a firm in Wales for the sale of motor cycles and side cars of every description, of 6 horsepower for side cars, and 4 horsepower and 2¾ horsepower for single-cycle work. Quotations should be given c. i. f. Swansea or Bristol channel ports. Reference.

284—A manufacturer in Canada desires to purchase in large quantities small wheels for boys' express wagons, of both wood and iron; wheels for hand carts, such as are used on delivery carts at railway stations; and wheels with both roller and plain bearings. Catalogues and quotations f. o. b. factory are requested.

299—A merchant in Norway desires to purchase and secure an agency for the sale of lubricating oils, greases, and automobile accessories. Quotations should be given c. i. f. Norwegian port. Payments to be made through Norwegian banks and New York banks. Reference.

300—A commercial agent in France desires to secure the representation of firms for the sale of automobiles and accessories. Correspondence should be in French. Reference.

309—A mercantile firm in the Maltese Islands desires to secure an agency and place a trial order for about 1,000 gallons of first-class motor spirit. Quotations should be given c. i. f. Malta. Payment to be made against documents through local banks. References.

320—A merchant in New Zealand desires to secure an agency for the sale of motor accessories and general merchandise, especially small lines. References.

The foreign inquiries are received mainly through governmental sources, and consequently some delay in reforwarding these must be expected. Answers should comply with the following simple rules: 1. Write one inquiry and only one on each sheet. 2. Give the number set against the inquiry below. 3. Write on your own business letterhead. Address, Commercial Inquiry Dept., Automotive Manufacturer, Heptagon Building, 153 Waverly Place, New York.

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. XLIII, No. 9 NEW YORK, DECEMBER, 1921 $2.00 Per Year Issued Monthly

Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City.
Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3.

The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

Vol. LXIII NEW YORK, DECEMBER, 1921 No. 9

Steam as a Motive Power for Motor Trucks

BY FRED HAMILTON*

Advocate of Steam for Automotive Vehicles Presents His Views—Important Because of Number of Steam Vehicles About to Be Placed on Market

IN THE industrial world, the uses of steam have been (and are) so varied and so uniformly successful that any attempt to discuss them would require a great amount of time and space, not here available. Except in a few localities where water power is available, steam is the scource of nearly all industrial power.

In the automotive industry, however, steam in the past has failed to take the place which justly belongs to it. Probably the chief reason for this has been the abundance of high grade fuel, easily converted into power through the medium of the internal combustion engine. The decreasing quantity of high grade fuel, together with the constant increase in demand has led to the consideration of some other power which can be generated from the cheaper and more abundant fuels.

While great strides have been made in the refining of internal combustion engines, it is nevertheless clear that inferior fuels demand greater complications, therefore a higher initial cost, a greater cost of upkeep and additional difficulties in adjustment.

There are two sources left, steam and electricity. Electricity at the present time is not commercially practical for overland work, therefore the answer is steam.

As a power for commercial vehicles in the automotive industry, steam has seven important advantages over the internal combustion engine. These may be briefly given as follows:

First—The successful utilization of the cheaper grades of fuels.

Second—The direct application of power which does away with many expensive parts in the transmission and clutch systems.

Third—High torque at low speeds and a very nearly constant torque throughout the entire power range.

Fourth—The absence of vibration which allows lighter construction and consequently a great saving of fuel and tires.

Fifth—Absence of a great number of moving parts so common to the internal combustion engine and the consequent lessening of repairs and breakdowns.

Sixth—The fact that when the vehicle is stopped temporarily the engine is stopped and the consumption of fuel ceases.

Seventh—The fact that the power is all built up in advance of the time when it is required and stored in the boiler, ready for use at an instant's notice.

The problems of the steam designer are given below with their relative importance denoted by their respective positions:

First—The boiler.
Second—The burner.
Third—The pumps.
Fourth—The engine.
Fifth—The chassis, etc.

The boiler used in our trucks and tractors embodies several new features not found in other boilers of this type. It is of the vertical fire tube type with the flues completely submerged and having a water leg and steam dome. Several manufacturers have used and are using the water tube and flash types which will produce steam slightly quicker than the vertical fire tube when first firing up. However, the reserve supply of steam in these boilers is not sufficient to stand the demand of a truck or tractor under a suddenly increased load. Therefore we have chosen to sacrifice a few minutes when first steaming up for the increased supply during operation. In the truck under ordinary operation this difference in time would amount to a very few minutes.

The shell of the boiler is made in two pieces with the joint near the top, strongly riveted, and welded as an additional precaution. The shell is wrapped with three separate and distinct layers of No. 16 piano wire. Each

* Hume-Mansur Bldg., Indianapolis. Read before Indianapolis section, A. S. M. E., Oct., 1921.

layer is entirely separate from the other two and the breaking of one would not affect the others in the least. Before placing the boiler in the frame, it is heavily wrapped with suitable insulating material.

The flues are seemless copper tubing ⅜ in. inside diameter expanded into both the crown and upper flue sheets, which are threaded with a fine pitch shallow thread to form a better grip. The flues have a small steel ferrule expanded in both ends.

Owing to the difficulty of installation, poor steaming qualities and their tendency to pit, we have discarded steel flues and adopted semi-drawn seamless copper flues exclusively. Our boiler has incorporated in it a water leg or sediment chamber 3 in. deep and 3 in. in width and which extends entirely around the crown sheet. Any sediment or mineral deposits are washed from the crown sheet and into this sediment chamber by the natural circulation of the water in the boiler and by the sway of the vehicle as it passes over the road. Sediment is easily removed from this leg by simply removing the clean out plugs which are located in the bottom.

Scaling is entirely eliminated, due to the rapid evaporation and to the fact that a small percent of our cylinder oil (which is compounded) is introduced into the boiler. Two of the elements entering into this compound oil keep the lime and similar mineral deposits in a mud form.

The water level is maintained at the upper flue sheet by automatic thermostatic control. Fire control is automatic and by means of a conventional diaphragm automatic.

The burner is of the Bunsen type and will handle gasoline, kerosene, distillate or alcohol with absolutely no change or adjustment. In addition to its ability to handle fuel of poor quality, we might also add that it is not affected by water in the fuel. In this type of burner the fuel is first passed through a vaporizer, where it is converted into a gas by means of heat, after which it is introduced into the burner proper. A small pilot light serves to keep this vaporizer hot while the vehicle is standing and also to maintain the steam pressure. This pilot light also serves as the ignition system. While it is necessary to remove the carbon accumulations from this vaporizer, every 60 to 90 days, its noiseless operation and efficiency have led to its adoption as standard by this company, after exhaustive tests of all other known types. On our 5-ton truck weighing 9,860 pounds we are getting a fuel mileage of 5.27 miles per gallon of kerosene.

Our pumps are all of comparative small bore and long stroke, and are of the conventional plunger type. These pumps are mounted in a dry well sunk in the water tank where the heat from the condensed steam very effectively prevents any possibility of either the pumps or pump lines from freezing.

There are four pumps; two opposed water pumps, a cylinder oil and fuel pump. The two water pumps have a capacity of 2 gallons per minute at 10 m. p. h. We have experimented with larger bores and slower speeds, but at the pressure (600 lbs. per sq. in.) used in this work, the strain on the parts is too great. All parts of these pumps exposed to hot water are made of very best non-corrosive material.

I have placed the engine in the position of least importance among the steam apparatus connected with our trucks. This may seem peculiar; but, if the pumps will supply water to the boiler, the burner gets the heat units out of the fuel, and if the boiler is so constructed that this heat is conducted to the engine in the most efficient manner, then the problem of building an engine is comparatively simple. However, an efficient engine will serve to remove the load on the other parts to a large extent and in the construction of ours we have been particularly fortunate.

Our truck engine is of the two-cylinder, simple, double-acting type. It is non-condensing to the degree that condensing is not carried to a point below atmospheric pressure. The exhaust steam is, however, carried to a condenser, mounted on the forward end of the truck from which the condensed steam flows by gravity to the water tank.

The engine lies horizontally under the frame of the truck and is connected directly to the rear axle by spur gears. A 23-tooth pinion on the crankshaft of the engine meshes directly with a spur gear on the differential. The reduction in the present truck has been 4.13 to 1, but as this gives us a speed maximum entirely too high for a truck of this size, we are contemplating changing this to 6 to 1. It is a significant fact, however, that the ratio of 4.13 to 1 is large enough to give us all the power we have thus far had occasion to use, having pulled loads in excess of 89 tons and attained a speed of 40 m. p. h.

The engine is 4½ in. bore by 5½ in. stroke, with the full cut-off very seldom used except for very heavy duty.

The question of a valve gear for use with an engine of this type is much discussed. The gear, of course, must be reversing and one that will allow the variation of cut-off in both the forward and reverse positions. Of this type the more common ones are the Stevenson link (used on the Stanley steam car), the Walschaert, Hackworth, Gooch, Baker and Marshall gears, used at different times in locomotive construction, and the Joy.

The first named, Stevenson link, is the most compact and has the fewest moving parts of any of the reversing gears. The motion of the valve over the ports, however, is affected by the eccentricity and consequently the two ends of the valve cannot be symmetrical and the cut-offs for different valve travels do not come at the same part of the stroke.

The Walschaert, Hackworth, Gooch, Baker and Marshall gears give a very good motion to the valve and are simple of construction, but require an overall width of engine considerably greater than the Stevenson or Joy. With the space limited as it necessarily must be in truck construction, this is a point of considerable importance.

This leaves us with the Joy gear, which we have chosen for use in our engine. In this gear the valve motion is derived from a point on the connecting rod through a system of levers and a block sliding along a curved arc. No eccentrics of any sort are used in connection with this gear. Experts are all agreed that this gear imparts a very desirable motion to the valve, especially in its rapid opening and closing of the ports, and as the valve travel must be cut gradually from full stroke to no opening when reversing, the reversing is accomplished with a minimum of strain on the various parts. The cut-off in a correctly proportioned Joy gear comes at the same relative place in valve travel for any position of the gear.

Many designers object to this gear because of the large number of moving parts and joints to wear and become loosened. This would be a point of much importance on

large parts having much inertia and exposed to the dust and dirt in constructions similar to locomotives. However, in our construction the use of hardened steel bushings and pins completely submerged in a bath of lubricating oil has removed the difficulties caused by the wear and the parts themselves are extremely light. Our first engine has at this time been run more than 7,500 miles; there has never been an adjustment of any kind made in any part and the valves are timing as perfectly at this time as the day they were set.

The valves themselves are of the hollow spool type of piston valve, center admission, equipped with two McQuay-Norris rings on each end, running in a cast iron liner. This liner may be easily removed and a new one pressed in when worn. The hollow type of piston valve, together with the fact that they lie horizontally under the cylinders makes the use of cylinder drain cocks unnecessary. This statement, gentlemen, may seem peculiar, but it is a fact. We have started our big truck hundreds of times with the entire line full of water and have never had the slightest trouble.

The crossheads are of cast iron, sliding in manganese bronze guides. They are designed to give a very large bearing surface and ample provision is made for lubrication. The whole engine back of the cylinders is enclosed in a crankcase and lubricated by splash from the bath of oil in which the valve gear is submerged.

The wrist pin is of hardened steel and carried in an exactly similar manner to those in gas engine construction. The crank pin and main bearings are large S.K.F. ball bearings. The crankshaft is a short heavy straight shaft carrying two overhanging cranks and the counterweight, with the pinion gear in the center.

All parts of our engine which are subjected to any considerable stress are made of the best heat-treated alloy steels, and no expense has been spared in the selection of any of the materials used throughout the truck.

The engine is designed to run at a maximum speed of 900 r.p.m., and when running at this speed with full cut-off is calculated to develop 110 h.p. This is under-estimated inasmuch as we are superheating our steam sufficiently to deliver it to the engine at a higher temperature than when it leaves the boiler. Auchicloss (Link & Valve Motion, page 16) says the mean effective pressure with one-third stroke cut-off is equal to one-half the boiler pressure, which on our trucks and tractors is 600 lb. gauge pressure.

The usual formula of PLAN over 33,000 equals 146 h.p. at 900 r.p.m.

Our feed water is pre-heated by means of a coiled feed-water heater which is placed directly above the upper flue sheet and which is surrounded by the steam dome.

The superheater is shaped similarly to the feed-water heater and is made of the very finest grade of seamless nickel steel tubing and is placed directly in the firebox.

Aside from our engine being mounted directly on the rear axle, and forming a part of it, we lay no claim to any special feature of chassis design. In fact, we have designed our own steam units with the view of making them capable of being substituted for gas units in the standard chassis of various weights. The chief difference between a chassis designed for gas work and one for steam is in the weight. The absence of internal vibration in the steam driven vehicle allows the use of lighter construction throughout.

In our present truck we have not reduced the weight greatly as we have been more interested in the testing of our steam units. Our production designs however call for a truck weighing approximately 2,000 lb. less than the present job.

The Alena steam truck is designed to meet the growing exactions of the business world for constant and economic transportation duties. Trucks driven by internal combustion motors have not and never can meet these requirements. The following quotation from a leading English scientific journal furnishes us with a disinterested comparison of steam and gas propelled trucks and shows the superior performance of steam over its rival:

"For transporting a maximum tonnage over a maximum distance in a minimum time and at a minimum cost, the steam wagon takes an easy lead over its rival. Having made the statement that steam haulage is the most economical form of road transportation, it is necessary to give facts which will support it adequately. With this object the author recently caused careful investigation to be made by a trained staff into actual running costs of various types of steam and petrol (gasoline) motor wagons operating in the service of road transport firms and private users who have adopted motor transport over a considerable number of years and who have made an experienced study of working costs. Figures have been analyzed which represent in the aggregate 15,000,000 ton-miles hauled. The capacities of the vehicles vary between 3 to 6 tons and to obtain an accurate comparison, each performance has been adjusted to give the cost of hauling 5 tons over 1 mile. The investigation covered the performance of 100 steam vehicles by five different makers of note and also 100 petrol (gasoline) vehicles by nine leading makers. The costs given include all overhead charges, depreciation, interest, fuel, wages, repairs, etc., and have been obtained from actual wagons in every-day commercial work and are not makers' tests.

The average annual capacity of one 5-ton truck—75,000-ton miles. Average cost by steam to carry 5 tons 1 mile—1s 5½p (35c). Average cost by petrol (gasoline) to carry 5 tons 1 mile—2s 10½p (69c). Showing annual cost saved by each steam wagon compared with petrol (gasoline) to be more than $5,000.00. There are many steam wagons 10 years and over in constant and reliable service at the present time and the city of Westminister has today three steam wagons in regular service which are 20 years old and been in constant commission for that period."

(Signed) P. W. Robson,
O. B. E. of Lincoln.

(See Engineering, July 23, 1920, page 123.)

The author states further that when permitted to do so, the steam trucks by means of a trailer carry at times an overload of from 60 to 100 percent, which is quite beyond the scope of its rival.

In summing up the superior features of steam trucks we find them to be:

Rapid acceleration.

Control simple, easy and certain, which means safety.

Will creep uphill, on the level, or over rough roads or will attain full speed by simply moving the throttle.

Impossible to kill the engine at some critical moment, as for example, in the path of a fast moving train.

Engine can be reversed (with steam off) while going full speed ahead. No gear shift, carburetor, magneto or other complicated mechanism to get out of order.

Cost of upkeep reduced to a minimum.
Less than 50 moving parts in the entire truck.
No formation of carbon in the cylinders.
No burned out bearings.
Tire mileage practically doubled.
Burns low grade, inexpensive fuel.
Easy riding through steady application of power.
Plenty of reserve power, consequently no need to rush hills.
High starting torque.

EDITOR'S NOTE: The above should be understood to be Mr. Hamilton's personal views in this matter, and not those of AUTOMOTIVE MANUFACTURER. Adequate space will be extended to any advocate of the internal combustion engine desiring to controvert these views.

One of the newer steam cars now ready for the market, and apparently embodying some of the advantages claimed for steam by Mr. Hamilton, will be described in an early issue. This pleasure car, to sell close to $1,000, is claimed to give a perfomance equal to the average $1,500-$2,500 gasoline car.

Manufacturers to Prevent Automobile Thefts

The first step which the automobile thief generally takes in changing the identity of stolen automobiles is to change the engine numbers so that the automobile engine cannot be identified. Realizing the need for a method of numbering engines which would make it extremely difficult for thieves to change engine numbers, the automobile insurance companies suggested that the Society of Automotive Engineers should revise the method of numbering engines which was approved for general use in 1916.

It was understood that a 7½ percent reduction in theft insurance premiums would obtain if a method of numbering engines was adopted by the society as standard which would conform with the Underwriters Laboratories requirements.

The S. A. E. engine division consequently made a careful review of present practice, soliciting suggestions and comments from insurance companies, automobile and engine manufacturers and metallurgists in reference to methods of numbering engines. Several interesting but not feasible methods were submitted. The majority of the replies indicated preference for plain figures about ¼ in. high, deeply stamped into a pad or plain surface cast on the engine.

After holding two meetings at which this was the principal subject discussed, the following method of numbering engines is recommended as being the simplest, most effective and practical system for numbering engines which has been devised for protecting automobiles against theft.

The engine serial or identification number shall be placed near the top of the right-hand side of the crankcase proper in a position in which it can be read easily. It shall be between two vertical ribs or beads ¼ in. wide, ⅛ in. high, 3 in. long and 3 in. apart. The surface of the casting between the ribs shall be left rough as cast and unpainted on the finished engine. The numbers shall be evenly stamped in the casting 1/32 in. deep and shall be ¼ in. high and of script form. The first digit shall be stamped close to the left-hand rib and the last digit shall be followed by a large star or other character to prevent adding digits. A star or other character also shall be stamped immediately above and below each number to prevent adding another number. The numbers shall be stamped twice on each casting, to permit correcting any errors made in stamping either number. No other number or character shall be placed within the space provided.

By this method in case an error is made in stamping either number, an additional number would be stamped directly under or above the number, the number stamped in error being cancelled by stamping a horizontal line through it. In this way two correct unmutilated numbers would appear on each engine. In case errors were made in stamping both the original numbers, the casting would be scrapped as the system requires that at least one of the two original numbers shall be unmutilated in any way.

Among the several suggestions which were received as a means for preventing engine numbers from being changed were casting a pad of special alloy steel in the engine crankcase on which the engine numbers might be stamped, casting numbers of an opaque material in a cylinder block in such a way that X-ray photographs would show the numbers, using raised numbers and casting on a small thin brass plate with edges crimped down ⅛ in. and knurled so as to anchor the edges securely in the crankcase, the number being stamped in the brass plate in the usual way.

The recommendation of the division will be acted upon at the Standards committee meeting in New York at the Engineering Societies building on Jan. 10.

No Fixed Definition for Motor Trucks

What is a motor truck?

There is no universally accepted standard of what constitutes a motor truck in the various states, says the Bureau of Public Roads, United States Department of Agriculture. As a result, only 13 states have furnished the department with the important data—so essential to road building—as to the sizes of trucks and commercial cars using the nation's highways during the first six months of 1921.

"In some states," says the department, "all motor cars are registered on the same basis; in others, only cars having solid tires are classed as trucks; while in others all motor vehicles used for carrying freight or merchandise of any kind whatever are classed as trucks. Even those states which provide for a separate registration for motor trucks do not employ the same basis for designating the size of the vehicle. Some states use the total weight of the loaded vehicle, others the weight of the unloaded vehicle or the weight of the chassis, and still others use such indefinite bases as the horsepower or the cost of the vehicle."

The need for definite and uniform information concerning motor trucks in use on roadways is felt, the department says, in the preparation of data which will enable road builders to take accurately into consideration the effect of such traffic.

420,000 automobiles in Canada covered a road mileage in 1920 which exceeded 1,680,000,000 and registered a passenger mileage of not less than 6,920,000,000. The steam and electric railroads of the dominion combined covered but 629,121,000 miles, the number of passengers carried being 252,000,000.

Touring Body With Unusual Features for Lancia Chassis

Low-Sided, Boat-Shaped Body With Tapering Rear to Reduce Windage, Presents Unusual Combination of Raised Seat Backs Inset from Beveled Edge

ONE of the disappointments of the recent closed car show, and also of the Importers' Salon, was the lack of a new and different body, of outstanding beauty and utility. Each year in the past the display of supposed imported cars, now largely composed of high-class domestic products, has included some one or two outstanding bodies, which were generally considered as supremely beautiful, very useful, and above all, quite different. This year however, although there were novel tendencies, small advances, the outstanding new and different body was lacking.

To offset this lack, there is presented herewith a new English design, which seems to fulfill these requirements. As shown in Fig. 1, which represents a full side view, this is a four-passenger touring body mounted on a Lancia 35 h.p. chassis. In a general way, this design reproduced from Cooper's Vehicle Journal, is intended to fill the need for a low-sided body of unusual lines, as smooth as possible, of a boat shape tapering form at the rear to reduce windage and eliminate dust, and at the same time give unusual comfort at the seats. The latter, as will be noted immediately, is accomplished by the use of high-raised seat backs, these being inset from the beveled edge of sheer line. This beveled edge blends off into the rounded upper curved surface of the boat-shaped rear, and the rounding sides of the cowl, so that the seat and edge arrangement harmonizes with the whole balance of the design, while the long horizontal double lines of the edge go well with the long, horizontal top and step lines, above and below respectively.

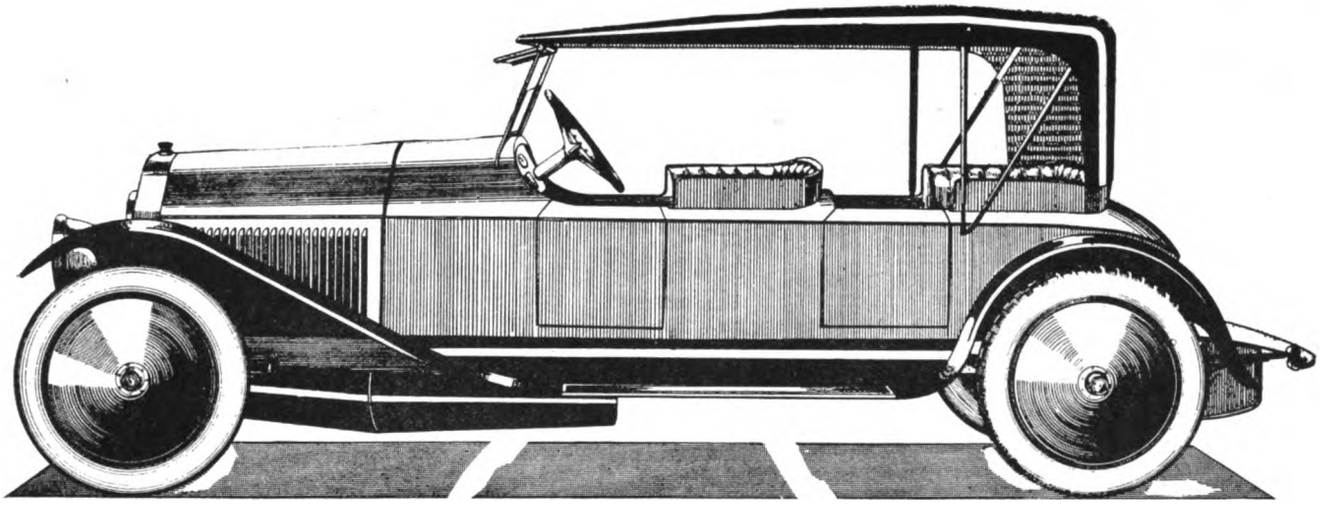


Fig. 1. Full side view of the completed four-passenger touring body, indicating the raised seat backs within the body edge.

The touring is the body which gives the greatest latitude for variety in design and appointments, more perhaps than any other. The extent to which this may be carried out, of course, depends on individual taste and from the body builder's standpoint, the price which he can obtain for the work.

A reference to the design, as shown in Figs. 1 and 3, shows that the long sloping front fenders, with short running boards, and shallow doors having square corners, are arranged in keeping with the high cowl. They are also harmonious with the sheer line of the side, this being at the same line as the bonnet hinge line. Mounted on the Lancia chassis, it can not be denied that it has an ensemble of more pleasing proportions and greater beauty, than as well as the more prosaic fact that it is fast superseding the distorted shapes of many so-called stream line touring bodies.

The general outline, being more decided and reguarly defined, has a good effect, besides presenting a lighter and more finished appearance than if shaped in a deeply curved formation from the elbow rail at top to the frame at the bottom.

The top is of the one-man type, this particular design being the patented No. 2 Charleville, constructed by Chas. Bunn, Ltd., West Bromwich. It has the front cross member locking onto spring catches on top of the sloping windshield supports. This windshield is inclined at an angle of 20 deg. from the vertical. In the body construction, aluminum is used and recommended for the panels, so as to conform with the lines of the body, especially the various curvatures of the back part, more readily.

The framework, as Fig. 3 shows, is of ash, using the strongest and best for the bottom frame, which is made up with cross bars, and framed according to usual practice. The pillars are erected and rails inserted as shown in the several sectional parts, marked AA, BB and CC in the working drawing. In this also, can be seen the exact position of the several pillars, and the height of rails above the bottom frame.

Bent Wood for Seat Backs

In making up the raised seat backs, the best and neatest finish was obtained with bent wood. This does away with all joints; they are easily fitted and strengthened with plates on the inside, making a firm job, and give a good basis upon which to fix the upholstery.

At the back of the front driving seat bent rail, the swept bridge rail is fitted. Care must be taken in supplying the wood benders with the correct pattern for the corners, together with over-all widths and depths of rail, allowing for an extra inch for rabbeting on to the body rails, to which they are fixed with screws.

In this way the seats are contained within the body, while the line of the top panelling is unbroken with shallow sides; space is obtained for a deep back squab that will, with the seats pitched to a forward inclination, give the necessary support to the occupants' backs and shoulders, a point that is often an important deciding factor in the selection of bodies, especially of this somewhat sporting character. In fact, this is a splendid point to remember with reference to all upholstering; where space limitations permit, a high back will always give greater comfort, and thus, have greater selling advantage, than a low seat back.

The working drawing, Fig. 3, shows clearly all details of the frame-work, and it is only necessary to add that, in building a body of this description, for the best results to be obtained with correct lines that will accord with the chassis design, and give little trouble when actually bolting on the body, a full size drawing should be prepared with a developed plan of one side of the body; in this way accurate patterns and measurements can be taken.

Sloping Windshield Is Adjustable

The adjustable windshield, that is mounted on the top of cowl, is fitted with small collars, the cowl being pierced to take the flaps of the stays, that are bolted on the inside. This makes a much neater finish than the usual heavy unsightly flaps bolted on the outside.

An important piece of the front framing is the swept cowl rail, which has to be cut out of a thick piece of timber in order to work up the corners, and to obtain a good fixing on the front pillars, to which it is lapped and screwed. To the underside are fixed two corner plates that have flaps to take the instrument board. The head stays, which are shown coming through the body side below the sheer line, have a stay on the inside that is carried down and bolted to the bottom. The cross body span iron should be made from 1⅜ in. by ⅜ in. iron with flaps up the pillars on each side, the other ironwork being corner plates at the back bar, and bracket plates at the seats as usually fitted to touring cars.

A good finish is obtained at the raised backs by screwing on polished wood fillets all round. It is more expensive than metal beading, but when well done adds considerably to the appearance. If required as an addition, a back extending screen can be easily fitted to fold beneath the bridge piece, forming the rear cowl.

The important general dimensions and details of the framework are given in the accompanying tables.

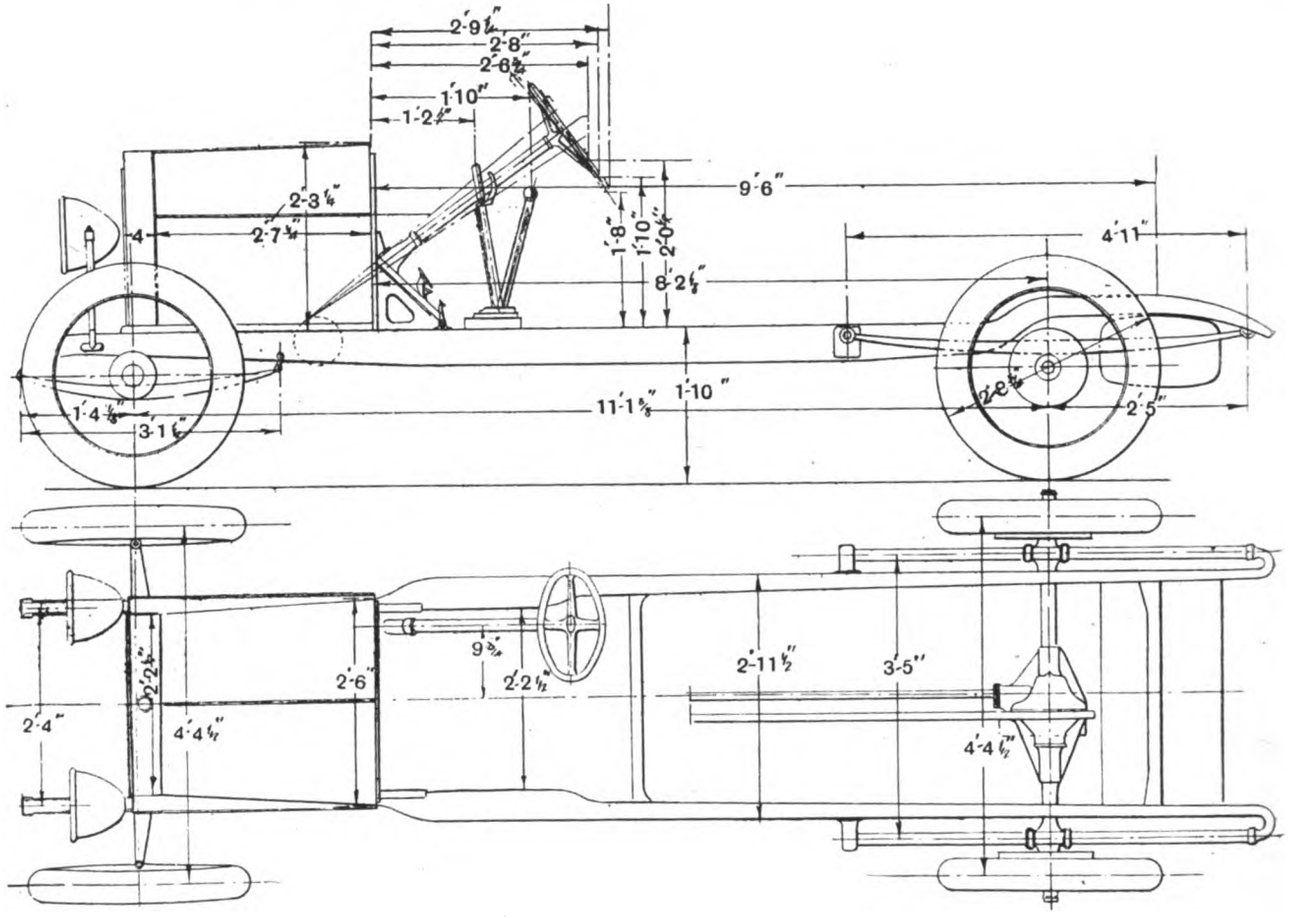


Fig. 2. Body builders' drawing of the Lancia 35 h.p. chassis showing the principal needed dimensions.

GENERAL DIMENSIONS

	ft.	in.
Length from dash over all on bottom of body	8	9½
Length from dash to back of front seat	5	0
Length from the back of driver's seat to rear seat	3	6
Length from dash to front shut pillar	3	3½
Length from dash to rear shut pillar	6	7
Width of doors	1	6
Depth of body sides at sheer line	1	4½
Depth over all of body sides in center of doors	1	6½
Height over all of seats at back	2	0½
Height of seats at elbow rail in front	1	10¾
Width of body over all on bottom	3	8
Width of body on top at the widest part	4	4

DETAILS OF FRAMEWORK

No. of Pieces	Part	Material	Length ft.	Length ins.	Width ins.	Thickness ins.
—	Runners	—	—		—	—
2	Bottom sides	Ash	8	9½	6½	1½
3	Cross bars	Ash	3	6	5	1½
—	Rocker pieces	—	—		—	—
2	Front standing pillars.	Ash	1	4½	1¾	1½
2	Hind standing pillars..	Ash	1	4½	1¾	1½
2	Hinge pillars	..sh	1	4½	1¾	1½
2	Back pillars	Ash	1	2	1½	1
—	Pillar tops	—	—		—	—
2	Corner pillars	Ash	1	2	1½	1
8	Door pillars	Ash	1	3	1½	1½
—	Door rails	—	—		—	—
4	Door top rails	Ash	1	5	1¾	1½
4	Door bottom rails	Ash	1	5	3½	1½
4	Door battens	Ash	1	5	1¼	1
—	Cant rails	—	—		—	—
—	Front top rail	—	—		—	—

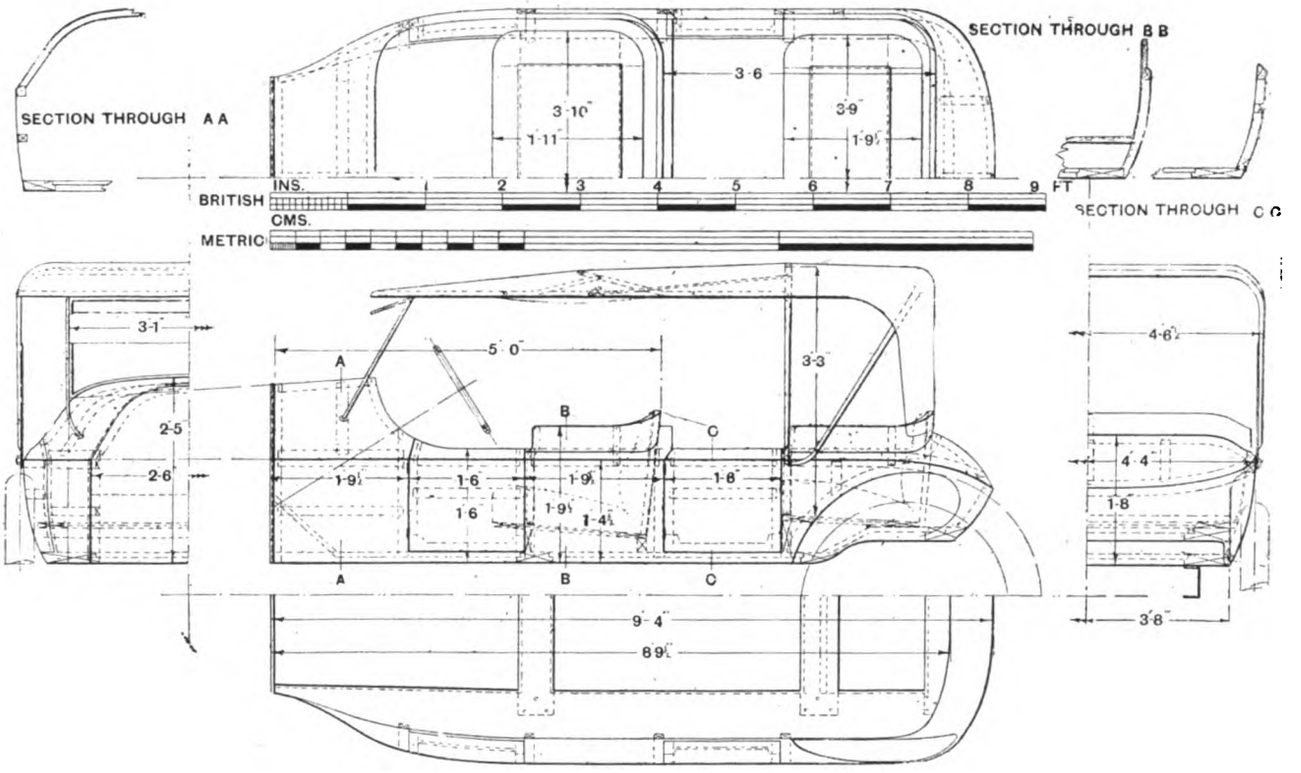


Fig. 3. Working drawing of the actual body, indicating principal dimensions in feet and inches.

1	Front middle rail	Ash	4	3	5	1
1	Back rail	Ash	4	3	5½	1
—	Hind top rail	—		—	—	—
—	Hoop-sticks	—		—	—	—
6	Body Battens	Ash	1	4	1½	1
4	Cowl framings	Ash	1	8	1¼	1
3	Seat rails	Ash	3	11	1½	1
—	Paneling	Aluminum	48		super.	18 BWG
—	Roofing	—		—	—	—
—	Flooring	Yellow Deal	20		super.	⅜
—	Lining boards	Pine	12		super.	¼
—	Solid sides	—		—	—	—
—	Step pieces	—		—	—	—
2	Polished fillets	Mahogany	7	3	1	¼
—	Inside paneling	Mahogany	10		super.	5/16
—	Canopy bends	—		—	—	—
2	Running boards	Kauri Pine	5	9	11	7/8
—	Rocker sides	—		—	—	—
—	Screen pillars	—		—	—	—
—	Heel board	—		—	—	—

S. A. E. Aids in Cutting Production Costs

Simplification is probably one of the most important means of cutting production costs, but it cannot be accomplished by the individual manufacturer without the whole-hearted support of the financial, sales and production executives. To obtain the greatest reduction in cost it is necessary, however, that such simplification be carried beyond the plant of the individual manufacturer until, by cooperative effort, a national simplification is accomplished which will react with tremendous advantage to each manufacturer. Such cooperative simplification between manufacturers, or standardization, is carried out most advantageously by trade organizations.

In the automotive industry the Society of Automotive Engineers, functioning through its standards committee, has made possible his coordination of effort which has resulted in the application of standards and consequently the cutting of production costs to a great extent. Additional standards—each representing a possibility of reduced costs—will be acted upon at the standards committee meeting on Jan. 10 in the Engineering Societies building, New York City, sixteen divisions representing different fields in the automotive industry and part or material manufacturers will present over 30 proposals for adoption as standards. The iron and steel division will submit a complete revision of the present iron and steel specifications which have been so widely used in other industries than the automotive since they were first published in 1911. The revised report is based on a great number of laboratory tests carried out in metallurgical laboratories throughout the country. The following parts and materials are included in the various reports:

Ball bearings, roller chains, sprocket cutters, generators, insulated cable, starting motors, carbureters, fan belts and pulleys, mufflers, running-boards, iron and steel specifications, non-ferrous metal specifications, rod-ends, lock washers, pressure gauges, pneumatic tires, clutch facings, tire-pumps, three-joint propeller shafts.

French Automotive Production

It is estimated that during 1921 France produced 53,000 passenger cars and 2,500 trucks. Citroen is the leading quantity producer, with 15,000 cars during 1921, which is possibly less than half the capacity. Commercial Attache W. C. Huntington, at Paris, states that 55,000 people are engaged in the manufacture of chassis and parts, 15,000 on body work, and 10,000 on accessories, making a total of 80,000 people on the payroll of automotive manufacturers.

Compounding the Combustion Engine

BY ELMER A. SPERRY*

Results of 30 Years' Study and Experimentation Showing New Compound Diesel-Type Engine Weighs 1/10-1/20th for Equal Power Output, Has Higher Efficiency; Is Simpler and Cheaper

THE high-compression or Diesel cycle in combustion engines has worked nothing short of a revolution, having brought to the prime mover the highest thermodynamic efficiency known. The fuel economies of these engines have forced them to the front. They have become extremely reliable and easy to operate; instances are becoming common of long runs without overhaul—long-continued performance without shutdown or forced stop of any kind. There is one record with a marine Diesel of 27,000 miles without trouble or adjustment. Another engine ran 18 months, 24 hours daily, with 2 hours' shutdown each Sunday morning for inspection, no part being replaced during this time. A Diesel ship of 8,000 tons, 2,500 i.h.p., has run continuously for 10 years; her mileage is more than 500,000 and still "going strong"; her lay-ups for repairs to machinery have been small and on the average less than with steam equipment.

There are now 325 Diesel-engined ships with more than 1,250,000 tons, ocean-going. About 90 percent of the cancellations during the recent depression have been for steam vessels. At first steam engineers refused to operate Diesels in ships, but now they are leaving steam vessels and seeking jobs on Diesel ships.

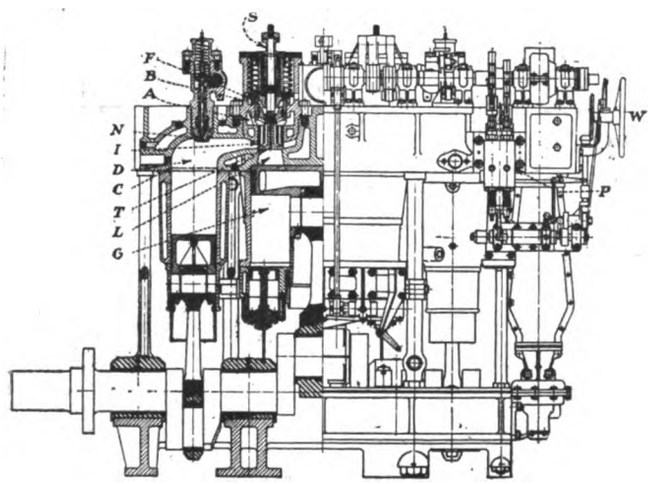


Fig. 1. Section and partial elevation of compound oil engine, showing details of construction.

As experience is gained with Diesel engines there have developed objectionable features which are serious. The three-stage high-pressure air-injection pumps are more or less sensitive and require considerable experienced attention; the great weight of the engines and the heavy first cost. Though they occupy somewhat less space than boilers and engines, the weights of Diesels are on a par with or in excess of reciprocating engines with their boilers and decidedly in excess of water-tube boilers and turbines. The standard product of the largest builder of Diesel engines for the merchant service weighs about 450 lb. per shaft horsepower and is large and bulky. A substantial increase in tonnage carried would be secured could these engines be lighter and smaller for the same power.

The weight is not the only difficulty with these large engines however for they cost more than steam equipment of equal power. One instance of $200,000 excess for a 3,500-s.h.p. ship is cited. In another ship for the same service and of the same power the weight was 60 percent in excess of the turbine equipment and the cost 212 percent, amounting to $306,000 excess. Notwithstanding this extra capital charge, the first ship at three-fourths capacity in the Far East trade can earn nearly double net (83 percent) over its turbine competitor of the same power and construction and with its machinery weighing a third more than steam.

It has been found that almost without exception Diesel oil must be employed. This is a partially refined product costing considerably more than bunker oil burned under the boilers. The differential price in Diesel over bunker fuel is large and is a handicap destined to grow more serious as the demand for gasoline for automotive purposes requisitions more and more of the Diesel fuel for cracking. The successful engine must use a wide range of the cheap fuels picked up in any market without alteration or adjustment.

The fuel-oil problem in itself renders some advance imperative. Conservation of our oil should be backed by government enforcement to stop the prodigal waste.

In a report made by a group of engineers in 1910, it was stated that if the combustion engine could be successfully compounded, a most important gain would be made in its weight and size. The fact that compounding presents other advantages has been known to engineers for a number of years, but the difficulties have been looked upon as insurmountable.

Diesel himself in the 90s undertook to construct a compound and his total failure was widely advertised. Subsequently, Guldner made the statement that any compound gas engine was certain to prove a failure. Together these two retarded combustion-engine advance for upwards of 20 years.

A year ago Professor Watkinson, Liverpool University, in discussing a paper by Engineer-Commander Hawkes on the Admiralty's extensive research on Diesels, stated, in substance, that we must recognize that the combustion engine in its present state was very crude and in compounding only lies the line along which the next great step in progress would be made. And he also stated that much greater results are bound to follow the compounding of combustion engines than was ever realized by compounding steam engines; first, because of the very much greater range of pressures available, and secondly, because the great enemy to compounding in steam, viz., condensation, is not present.

The author has been active in this field for 30 years, one of his early patents being dated Dec. 10, 1892. Dif-

* Abstract of paper presented before Amer. Soc. Mech. Engineers, Dec., 1921.

ferent engines have followed each an improvement over the preceding, until the principle has been thoroughly established and proven. Moreover, the heavy-duty compound has shown that it includes everything that was hoped for. It is light compared with the normal Diesel, being in special cases less than one-tenth, and in some instances less than one-twentieth, in weight for the same output. Its mechanical efficiency is extremely high, a distinct gain in overall efficiency from fuel to shaft has been made, as well as a very definite gain in simplicity, direct performance and smoothness of the crankshaft diagram. This has been achieved while adhering to the best practice, namely, four-cycle operation.

Compounds Lighter and Cheaper—Much Larger Units Possible

The lightness and simplicity of the compound solves the capital-charge factor automatically. Engines and machinery in the final analysis usually cost a given amount per pound. It is found that there is no structural demand or refinement in the compound that has not already been met in the Diesel—the same range of pressures and temperatures are handled throughout by the effective two-stage method, which is now well established. Engines of this type weighing only a fraction of the weight of the present Diesel will inevitably be found to be much less in first cost as well as in cost of upkeep.

Much higher powers than are now available are thought to be of extreme importance and much interest is centered upon the question. The more advanced among the Diesel builders are concentrating upon still higher powers from a single cylinder working on its present cycle. This will increase the weight per horsepower. The compound will solve this problem, for within present cylinder and cylinder-wall limitations, powers in excess of 10,000 h.p. per engine are entirely practicable and are accompanied by all of the proportionate savings in weight, space and capital charge pointed out.

Our own government has watched the progress of this work for years, inspected the development in its various stages, and has come forward with orders for an initial engine which, together with other orders, is now under construction. To illustrate to what low figures the compound principle will bring the heavy-oil engine, among these orders is one now under construction to weigh about 5 lb. to the brake h.p. This may be looked upon as extreme, but the designed weights and finished parts as they now stand are below this figure. This brings us within striking distance of aviation engines, where the fire risk through the presence of gasoline and the electric ignition system constitutes one of the greatest menaces to aviation progress. The remarkably high mean effective pressures of the heavy-oil compound will give us the aviation engine and entirely eliminate both these sources of fire risk.

The reason for the great weight in all classes of Diesel engines is apparent when it is understood that they are designed around an extremely small quantity of air and oxygen at each stroke, an amount so minute as to be surprising compared to the ponderous engine itself. The volume of the power gases available to do work is limited to the size of the combustion space, and this is confined to a small crevice in the end of the cylinder one-twentieth of the travel of the piston. Attempts to make it larger produce both compression and ignition temperatures that are too low and we have semi-Diesel and surface-ignition engines confined to smaller sizes and tendencies to a lower grade of performance. Such engines are difficult to start and represent no gain in weight.

Two of these volumes are sometimes combined as in the opposed Junkers engine. The size of the combustion space, though still minute, is known to give some small advantages over the regular engine which has only one-half of this space, but has the disadvantage in common with all two-cycle engines of the frictional piston-ring support practically without lubrication on the hot bridges as the exhaust port is uncovered by the piston. These latter require an added structure in the form of a large scavenging and air-supply pump, connections, valves, etc. They are also very heavy. An apparent four-cylinder opposed engine is really an eight-cylinder engine requiring 12 cranks.

Supercharging or compressing in two stages gives the controlling advantage in that a very much larger unit volume of gases may be handled. The clearance spaces may be many times the size of those in the Diesel, and yet it is perfectly simple to bring these large volumes up to the requisite pressure and incandescent temperatures at the instant of fuel injection.

The large volume of power gases in the combustion chamber of the compound solves a number of important problems, makes the light engine easy of accomplishment, and overcomes a number of other difficulties at the same time. No longer is the chilled perimeter per unit volume

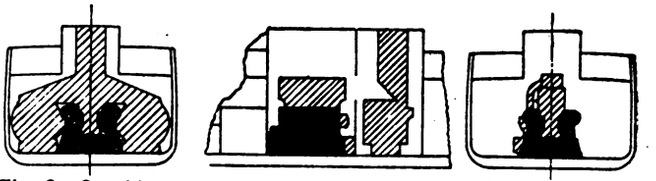


Fig. 2. Graphic comparison between reciprocating steam plant (light cross hatching) and geared compound Diesel engine (dark shading).

of gas the controlling factor, as it is in the Diesel. In the large dome-shaped clearance space the volume has increased very much more rapidly than the perimeter. This is again vastly increased in the low-pressure cylinder, where an extremely large volume exists with still smaller ratio of chilled perimeter. Taking all into consideration a gain is made of 60 percent in the compound compared with the simple engine.

With the large clearance volume we no longer have difficulty with solid injection, nor do we have any difficulty in using a wide range of heavy fuels. It has been known for years that as soon as the oil spray encounters chilled or even red-hot walls, the efficiency drops. Here the oil fog may penetrate the deep masses of hot compressed air with instantaneous effect in every direction from the spray nozzle without encountering chilled walls, and instantaneous and very complete combustion results. In the compound engine the clearance volume is so large that the entire high-pressure piston displacement causes it to lose only a fraction of its pressure, thus bringing to the second stage, or low pressure, both ample volume and pressure so that this piston (representing 6, 8 or even 10 times the area of the high-pressure) is driven to the end of its stroke with pressures still above the atmosphere.

Much Greater Expansion, Higher Efficiencies

In this way the engine yields an expansion ratio based on gage pressures, which instead of 3 or 4 to 1, as in the automobile engine, or 12 to 1 in the Diesel, can be made

120 to 1. The great volume in the combustion space furthermore allows this space, without distortion, to extend easily out over the top of the low-pressure piston, making a most direct connection therewith through a short transfer port. And finally this large clearance space allows its shape and contour to be grouped almost solely with reference to the most complete dissemination of the fuel and highest combustion efficiency.

In automotive engines, detonating has been considered unnecessary and important moves have been made toward eliminating it. Similarly, the British admiralty attempted to eliminate it in Diesel engines but found this impossible without increasing fuel consumption. It found, further, that higher thermodynamic efficiency accompanied high detonation than low. The author claims that in the compound Diesel this is a desirable feature, because of the accompanying high efficiency, and has discovered (and applied) means for securing it invariably.

Similarly with the losses in the transfer; in all early attempts at compounding, these were found to be prohibitive, but Mr. Sperry claims to have found a way out, in cushioning, that is closing the exhaust valve at a predetermined point before the end of the out stroke, trapping a small part of the hot gases, and cushioning them up to the transfer pressure so that the transfer valve opens with equal pressures on each side. There are practically no losses in this process, and the additional advantage is secured of preventing erosion due to the high velocities of the hot gases over the transfer seats. Incidentally, this adiabatic compression of the hot gases brings equality of temperatures as well as pressures, and thus has a marked influence on the higher efficiencies obtained.

Preignition has had some attention also. Work by the Bureau of Standards showed that no preignition occurred with late rises in pressure but only with early high pressures, in which case they combined with further compression, and thus, rose to dangerous values. Two-stage compression eliminates this possibility because all early compression occurs extraneous to the combustion chamber, and is concerned with air only. This arrangement eliminates safety or pressure relief valves, and thus, effects desirable simplification.

The Transfer-Valve Problem

The transfer valve considered as an exhaust valve is called upon to handle much hotter gases than heretofore. It is known that the exhaust valves of the Liberty motor run red hot and the stems white hot, and yet they are handling gases of lower temperature than are present.

These transfer valves may be water- or mercury-cooled. It must be remembered that compression in the compound is by the modern two-stage method. Air is admitted to the combustion chamber under comparatively high pressure and although it is warm, yet with each atmosphere of pressure its cooling powers are doubled. Air at 100 lb. thus has 7 times the cooling power of amtospheric air, 7 times the weight and 7 times the molecule in contact for cooling. In forcing the high-pressure piston down air must pass some port in entering. This port is in line with the transfer port and the induction valve itself rides on the back of the transfer valve in the form of a hollow sleeve I, Fig. 1, seated directly on the top of the transfer valve T. The back of the transfer valve is provided with greatly enlarged radiating and cooling surfaces presented to this cooling air and powerful convection currents are constantly acting when sealed. Moreover, this air entering at high velocity over the deeply serrated surfaces of the transfer valve takes up the heat very completely.

Intensive Cooling Effective

In following out the cycle, it will be noticed that this step follows directly the transfer of the hot gases and continues throughout the next quarter cycle and through the entire descent of the high-pressure piston. In this way it delivers a real power stroke to the crank with mean effectives in some instances greater than those of the ordinary Diesel, thus returning some of the power taken to drive the supercharger or first stage pump. If the transfer valve is intensely heated on its under surface (see T, Fig. 1) and is then instantly intensely cooled on a surface five times as great, it will certainly maintain a heat balance which is extremely low, only about one-half the temperature of the Liberty valves, nowhere nearly approaching red heat nor the temperature of normal Diesel exhaust valves under load conditions. Here we have the crux of successful compounding, the great obstacle which has always been looked upon as practically insurmountable, solved by an extremely simple and straightforward method.

The heat in these gases absorbed from the hot valve is useful inasmuch as it is the auto-ignition temperatures as well as pressures that are required at the end of the compression curve. Here a useful heat transfer and pure regenerative process is carried out. The seats give no trouble because they are backed by the ample water jackets and in fact, the whole transfer valve gear operates continuously and successfully and is found to be in perfect condition after hundreds and even thousands of hours of operation. They require practically no attention and are seldom ground in.

How Lightness Is Obtained in the Compound Engine

The question often asked is; to just what is due the smallness and lightness of the compound engine? It is this: In the four-cycle Diesel we have the tonnage of metal due to the presence of high pressures, operating at a low material efficiency because these high pressures persist only about 2½ percent of the total time. The Diesel card rises abruptly and immediately falls. All the rest of the time, over 95 percent, either low pressures or no pressures at all are present, whereas in the compound the pressures persist and we are dealing with great blocks of power. Although the pressures are not materially higher than in Diesel practice, they persist clear across the card, producing very large gross mean effectives. This is instantly followed by another line clear across the card, producing another large gross mean effective in the low-pressure cylinder when referred to the high-pressure area, all from a single fuel injection. Instead of 60 to 70 lb. net mean effective to the crank, delivering its power through a few degrees only of one stroke in four, in the compound we have two net mean effectives, each of 300 or 400 lb. per sq. in., succeeding each other and covering two strokes out of the four from a single fuel injection. The point is that these two large blocks of power are secured not by any material increase of pressure, but by using large quantities of power gases, and "hanging on" to the pressures we have in those gases throughout practically two complete strokes, clear across the card twice, thus abstracting much more of the power they contain before exhausting. Suppose these to be 330 lb. per sq. in. each. Added they make 660, which is easily ten times 62 lb., a net mean effective not infrequently met with in ordinary Diesels.

The power gases work in the Diesel about 120 deg. of arc and in the compound 315 deg., or 2.6 times as long: or, considering the points of "cut-off" the true expansion curve is 3⅓ times as long, which accounts for its large mean effectives and higher economies.

Proper Ratio for Compounds

As to the proper ratio for compounds; engines of 10:1 ratio of low-pressure to high-pressure cylinder areas, also 8 : 1 and 6 : 1 have been made, operated and studied, the small ratios being at present considered more desirable. The weight factor does not change materially with changes in ratio in this region. The low-pressure piston operates two-cycle. The power distribution and the weight of the reciprocating parts both equalize best at about 6 : 1. This makes a perfectly balanced unit, the end masses equaling and also moving oppositely to the central. The two full power impulses following each fuel injection are also about equal. Thus full four-cylinder performance is secured with only three cranks and two extra power impulses are delivered on the induction stroke, making six power impulses for each cycle.

Another unusual advance should be noted; complete reversibility and self air starting are secured without additional valves or cams over the simple, one way engine without air starting, there being no difference in this regard. Again comparing the full-reversing, air-starting compound unit with a similar four-cylinder Diesel of any prominent make, delivering the same number of primary power impulses to the crank, the latter has 16 valves and 32 cams. The former operates the same cycle with two extra power impulses over the Diesel and only 5 cams driving 7 valves.

Eliminating the three-stage air injection pump with its intercoolers and other complications, constitutes an important simplification. Doing away with the use of high-pressure air with the fuel conserves heat and eliminates one serious previous drawback of the Diesel. In the compound solid injection is used and the engine is controlled by varying the amount of fuel through the valve mechanism.

Internal Construction of the Compound

Now as to the construction of the compound, Fig. 1 shows an elevation to the right of the center, and longitudinal sections to the left. The two high-pressure or combustion pistons on their out stroke are at the ends, and in the center is the low-pressure at its extreme in stroke. The sturdy construction is indicated by the size of the crankshaft, about 50 percent larger than in any other combustion engine of which the author has knowledge, approaching, as it does, the bore of the combustion cylinders themselves. The fuel pumps P and the control and manipulating wheel W are shown in elevation to the right. To the left the large dome of clearance D, forming the combustion chamber of the compound, stands out in marked contrast to standard Diesel practice, which is shown by the little space C between the solid horizontal line at the base of the clearance and the dotted horizontal line just above. The dome is large and forms an upward extension of the combustion cylinder, extending also to the right in a large sweep surrounding the transfer valve T which seals the transfer port L. The sleeve-like induction valve I is shown seated on top of the transfer valve and is controlled by the cam-operated fork F. The transfer valve and sleeve are lifted by a fork not shown, located in thimble S near the top of the stem. The first-stage annular compression pump G surrounding the trunk piston below the low-pressure piston proper, delivers its air to a small receiver, which in turn discharges to the cored port A surrounding the induction sleeve I, the cooling action of which has been described. The little balancing cylinder B sustains a permanent connection with the low-pressure cylinder. The solid-fuel injection valve and nozzle N are placed approximately over the center of gravity of the large masses of air in the clearance dome D. The two high-pressure cylinders are operating four-cycle, one 360 deg. back of the other, discharging alternately into the low-pressure, which therefore works two-cycle and delivers power on each down stroke.

The difference between the compound with two high pressure cylinders and a two-cylinder ordinary Diesel consists of the extra crank, low-pressure cylinder with its piston connecting rod, etc. This addition which means about twice as many parts, twice as much machinery, gives more than seven times the power. It is obvious that a greatly increased efficiency is obtained, and with ordinary standard construction.

Due to its light weight for a given power, with resulting low first cost and capital charges, low costs for foundations, high speeds with consequent low costs for connected generators, small space required, simplicity and economy of operation, the compound has a very wide field of usefulness, including many fields. It is especially adapted for use in waterpower stations or for carrying the peak loads in central stations where installations as large as 21,000 kva. have been contemplated. Other uses for the compound which readily suggest themselves are city water works and irrigation projects, either directly or by electrical distribution.

Possibilities of the Compound Diesel-Electric Locomotive

The possibilities of the compound-Diesel-electric combination in this field should not be overlooked, as it presents all the well-recognized advantages of electric traction and several additional features, namely:

It represents a component part of the central power station, with the advantage over the latter that it operates at the highest thermal efficiencies known; the actual cost of the delivery of each kilowatt-hour to the motors is far less than by any other known means; the capital charges for main feeders, and the like are eliminated. The tracks are used exactly as they stand.

Application to Ship Propulsion

We now come to the greatest present employment of oil engines, namely, their substitution for steam in ship propulsion. M. L. Requa, former fuel administrator of the United States, states most emphatically that "steam equipment on board ships should from now on be regarded as obsolete." Dr. Norman, in Experimental Station Bulletin No. 19, quotes this and adds that "from the viewpoint of petroleum conservation and the fuel situation of the world, this statement cannot be too strongly endorsed."

The advantages of motorships are rapidly being recognized, and they are now being built in practically every maritime country more rapidly than ever before. The gross tonnage of ships equipped with Diesel machinery launched in 1913 was 60,000 tons; in 1919, 85,000; in 1920, 189,977; building last year 454,502 tons of Diesel-driven ships, or over 7 percent of the world's total under con-

(Continued on Page 22)

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO.

Heptagon Building, 153 Waverly Place, New York City

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXII December, 1921 No. 9

Tire Guarantee Abolishment Probable

FROM all appearances, the tire manufacturers of the country are about to drop all guarantees upon tire mileages effective at an early date. In fact, this situation has progressed so far that it probably will be closed before this issue reaches subscribers. The facts are that the Rubber Association of America has approved the elimination of mileage guarantees, and the substitution of a new form of warranty. The latter will concern itself solely with defective materials and workmanship and be good for 60 or 90 days from date of sale only, somewhat along the lines of the standard motor car and truck warranty.

Included in the Rubber Association are some 86 tire manufacturers representing 90 percent of the total production in this country. This action was followed by similar action of the Mid-West Rubber Manufacturers Association.

As a matter of real fact the mileage guarantee was not a real guarantee inasmuch as the motorist who had a tire fail to reach the set mark had to accept a new tire of the same make at a reduced price in place of the shortage, the reduction in price corresponding to the amount of the shortage. That is, having used a tire and found it wanting, the motorist was obliged to accept another of this make by way of satisfaction. If his first experience soured him against that make, the tire bought to replace it on adjustment had to do better than the guarantee to offset his first experience, that is it had to show him exceptional goodness. From the nature of things this was impossible in the majority of cases.

Realizing this sub-consciously, the majority of motorists made unusually strong claims, even going to deliberate misrepresentation, to get an unusually good replacement basis, thus, unconsciously also, discounting the tire in advance. A situation of this kind was bound to fall of its own weight in time, and that is what it has done now.

Actually, motorists will be better off, for with the mileage guarantee eliminated and its costs to the manufacturers taken out, tires of equivalent quality can be sold more cheaply. Moreover, the user is going to select his tires more carefully, inclining to the make which is putting in the most quality, so that situation will adjust itself quickly. With the guarantee taken off, motorists will use more care with their tires, which in itself should result in enough greater average mileage to offset the loss of the guarantee.

Everything considered, it would seem that the entire industry is beter off without it, manufacturers, dealers, and tire users, for it was an artificial thing, and had outlived its usefulness.

Motor Price Reductions

JUST as we go to press there are announced several new price reductions in well-known makes of cars. In two of the cases these, with two previous 1921 cuts, make up a total of one-third of the price asked at the beginning of the year, the cars in question being in the lower priced group, one in the $1,500 class, and the other in the below $2,500 group. Considering the extra equipment one of these is priced way below pre-war levels, in fact it is the lowest ever quoted on this particular vehicle, yet pig iron is still 50 percent above the pre-war level, steel is at least as high, the special steels used are even higher, the wood used is more than 50 percent above the ante-war level, and similarly with the fabrics and other raw materials, as well as with most of the accessories and equipment.

For the good of the industry, which must make a good profit in order to continue, it is to be hoped that the round of price reductions which this latest action has started will be the last, and that early spring will see the price situation wholly stabilized. If it does not, the year 1922 will be a very doubtful one, in fact under present conditions of still higher materials and parts, costs and declining selling prices, which begin to approximate costs, it is difficult to see how automotive executives can make plans for a very large output. And yet, their very salvation depends upon big production. We repeat, it is to be hoped that price reductions will all come at once and quickly, so that spring will see complete stabilization.

Pacific Coast Show

Most of the 35,000 sq. ft. on the main hall of the municipal auditorium, San Francisco, has already been applied for in the sale of space for the Pacific Coast Automotive Equipment and Accessory Exposition which will be held Jan. 21-26, 1922.

There will be working displays of all phases of the automotive industry as it applies to repairs, replacements, etc., as well as to products in process of manufacture. The working displays will be operated daily during the full time of the exposition.

The automobile owner will learn many things that will be of value to him or her, in reducing the cost of upkeep and repairs on the car. Those in the automotive trades will be shown many things that will enable them to turn out a more satisfactory job at less cost to the customer. Tools, equipment parts, machinery and accessories will all go to make up the display of one of the most educational shows ever held.

More attention is being paid to the decorations this year than to any previous one and the exposition will be one of the most attractive shows of its kind held in the country.

Industrial Standardization and British Auto Difficulties

BY GEORGE W. WATSON*

Past Difficulties of the British Automobile Industry Closely Bound Up in Lack of Standards. Obstacles to Adoption, Lack of Common Interests

RESTORATION of industrial prosperity is just as necessary in Great Britain as in any other country in the world, and the manufacturers are just as keen to discover how it can be accomplished as any others, Laying aside the political and other reasons for depression which are scarcely within the province of automobile manufacturers to discuss, or in discussion to remedy at all, there is a suggested line of action which if given personal and collective effort of all the manufacturers in this line, promises to afford particular relief, that is, standardization. It should be carried out by the British Engineering Standards Association, in collaboration with the Institution of Automobile Engineers, and every other association, body and manufacturer with any interest whatever in automobiles. The automobile section of the B. E. S. A. during the past year has been reorganized, and there are now good prospects of something tangible being done which should help to bring down the cost of production, both of details and completed machines, and once again put us on a more equal footing with other countries.

Past Difficulties in the Automobile Industry

British automobile engineering has had a most interesting and varied career. We have had persecutions, disappointments, phenomenal developments, and now stagnation, or something akin to it. Britons may always be proud of the fact that their forebears were among the earliest experimenters in mechanical locomotion on the highway, even if they bow their heads in shame at the memory of the acts of stupidity which crushed those early pioneers by requiring their machines to be preceded by a man on foot carrying a red flag. That act gave to other countries an advantage from which, to my mind, they did not profit to the extent which might have been expected. None the less, they went steadily ahead, and French engineers particularly produced vehicles, the performance of which ultimately convinced our slow-moving legislators that they could no longer stem the tide of development. Those of us who have been in the industry continuously since its early days following the emancipation of the motor car, can now recall with amusement our early experiences, but the fact remains that Great Britain, after a period of disastrous exploitation by financiers, quickly made headway, overhauled, and even surpassed the efforts of French, Italian and German engineers, until, just before the fateful year of 1914, our factories were producing the finest commercial vehicles in the world, while many of our passenger cars were likewise unequalled in other countries.

Except in a small measure, standardization in our industry at that time may be said to have been non-existent. How different now might be the state of industry had we taken up earlier this important aid to development! By the adoption of standards for many details which were of common application we should have been better prepared to meet any sudden demand for increased transport facilities without calling so largely upon the resources of other countries. The danger of this lack of unification, particularly so far as concerned vehicles for military transport, was recognized by many quite early, and with your permission I will quote extracts from an editorial article which was published in one of the motor papers in Sept., 1910. In that article we read:

Chaos in Mechanical Transport

"Under war conditions, three-quarters of the existing state-owned mechanical transport would be a delusion and a handicap to any commander; each two or three units would need their own load of spares; no important parts are interchangeable throughout any division of wagons or tractors.

"What would be thought if this state of affairs held sway in the artillery? What if a gun carriage or an ammunition wagon had to be abandoned because some little failure must involve long delay while a part was made and fitted on the march? What if it were the exception for any of the gun mountings and breech fittings to be standardized? Yet, in the growing arm of mechanical transport, at least so far, the necessities of the case have been sacrificed to short-sighted considerations which are wrongly supposed to reflect great financial acumen somewhere!

"A standardization committee should be appointed, and this should be constituted of members of the mechanical transport section of the A. S. C., R. E. officers, and accredited representatives of all motor manufacturers who are prepared to produce machines, suitable for military purposes, in accordance with the army's requirements under an adequate subvention scheme. Although it would not be in the interests of trade that one type of engine, clutch, gear-box, final drive, etc., should be adopted for all internal-combustion-engined machines, the individuality of the designer would not be smothered by the standardization of many detail parts. In the case of vehicles which are propelled by internal combustion engines, the following are a few of the parts which might well be made to a standard specification, and, if so designed, they would be interchangeable for all makes of vehicles of the internal-combustion-engined class of a given capacity: starting handle and spring; diameters of valves, valve springs, cotters, caps, etc.; cam rollers and tappets; clutch (diameter of plates and number of keyways if of disc type, and diameter and angle of faces if of cone type); shape, size and dispostion of the pedals; shape and size of radiator and bonnet; working positions of change-speed and brake levers; style and position of sprag, and means for indicating to the driver whether or no it is in working position; knuckle joints for steering gear, also knuckle joints for brake gear; brake shoes and drums; pitch, type and ratio of chains and chain wheels; diameters and widths of wheels and tires; sizes of bearing springs and spring shackles; sizes of strap bolts for springs; hub caps; floating bushings for road wheels; type and position of draw bar; height of carburetor jet and size of screw thread in base of same; gasoline and water strainers; gasoline tank

* Presidential address, before Institution of Automobile Engineers, London, Eng., Nov., 1921.

filling caps; and bolts. It might be possible to standardize the diameter of engine cylinders, and if this were done, one size only would be needed, respectively, for the big-end bushings, piston pins and bushings, and piston rings. In the case of steam wagons and tractors, the same process of standardization might be agreed upon."

"Were such a standardization committee appointed, we are convinced that nothing but good could accrue to the industry, as well as to the machanical transport undertakings of the army. The establishment of bases for repairs and renewals could then be placed on a business-like footing."

Shortly after the period to which I have referred a committee was called together, but the personal element was so strong that only a very meagre degree of standardization was agreed upon, and even these were carried into effect by only a few makers. One result of this neglect to tackle the question seroiusly was that we were unable to meet the immense demand when the call was made, and the condition of partial impotence in which the year 1914 found us gave to Americans an advantage which, coupled with the large measure of standardization they had already adopted, enabled their "component assemblers" to reap such a rich harvest. We are now paying the bill.

Why We Should Standardize

I have selected the subject of industrial standardization for my address for three reasons:

Firstly, because, by the standardization of parts we gain the advantage, through interchangeability, of securing to manufacturers uniform standards of materials and dimensions of parts which may commonly be used, and which, being adaptable to many makes and types of machines, may thus be produced in large quantities by specialists at prices which few individual makers could equal were they making similar parts for their own use only. The user benefits to an even greater extent because, once a standard has been adopted and made widely known, it is possible to buy it in almost every town in the country.

Secondly, the enormous growth of the automobile industry in the United States during the past 10 years is in a very large measure due to the adoption of a wide range of standards for materials and details, and even of complete units, with the result that there are now many powerful and successful organizations at work producing complete and interchangeable components. As a direct result there are also a large number of companies which, relieved of the capital cost if installing special machinery for the production of some or all of the components they need, are able to produce completed cars from components purchased outside in numbers unequalled in this country, even in our largest factories. The large home demand helps our American cousins to get down to rock bottom so far as costs of production are concerned, but I think it is the energetic manner in which the problems of standardization have been tackled, coupled with the loyal cooperation of the automobile industry in the use of such standards, that has done more than anything else to bring about the phenomenal development of the motor in America.

Thirdly. Hitherto, British industry has been more or less indifferent to the question of standardization, and while most engineers recognize its benefits if carried out in the true spirit of cooperation, many directors have been, and still are, apathetic in the matter; they vote money for standardization more in the spirit of charity donations than as matters of important business. If only they could be brought to realize that standardization is not only possible, but that it is a business proposition and that its successful prosecution would mean increased dividends, the future of our industry would be assured.

Production in large quantities, with special plant, to agreed specifications for materials, dimensions and performance, is the only sure way of cutting down costs. Every standard, however, must be in accordance with the fundamental needs of an industry, and it must have so much to recommend it that neither producer nor user can afford to disregard it.

Costs of Planning for Fresh Output

Every manufacturer knows only too well the heavy outlay involved in preparing drawings, patterns, dies, jigs and fixtures for the production of a machine, or part, to a specification which may differ only in nonessential details from another specification to which he may be working for another customer. This outlay, of course, has to be borne by the customer. Examples of these needless differences may be found in every factory where specialized articles are made as for instance pistons, piston rings, spring-shackle pins, etc. It is such details as these which most urgently call for the adoption of standardization. The requirements of the industry must be unified without hampering invention or destroying the individuality of the designer. Any standard should embody the combined experience of an industry so that it represents the best average practice; it can then safely be used as a purchasing specification. Some men argue that nothing should be standardized until we know everything about the subject, while others hold that, from the first, an industry should have provisional standards which may be revised periodically so that they do not limit progress. I think the former line of thought is to be condemned, as there are some things on which our knowledge may always remain incomplete, but there is no excuse for our continuing to interpret in a dozen or more ways such knowledge as we do possess. Let us get together and see each other's viewpoint then make the best of our present experience and revise the results as progress and requirements dictate. That is the policy of the British Engineering Standards Association. They do not initiate standards, but undertake the investigation of any subject at the request of an industry. Before commencing work on any one subject, they call a representative conference of all concerned in order to make sure that there is a consensus of opinion in favor of such work being carried out. The B. E. S. A. have no power to enforce any standard, but given the goodwill and cooperation of the automobile industry, I am sure that the past and future work of its many subcommittees and panels can only tend to the advancement of the automobile industry in this country, as the work of the Society of Automotive Engineers has done in America.

Failures in Standardization

There have been notable failures in both British and American standards, but those failures have been largely due to a lack of initial cooperation, absentation from participation in their framing by those whose experience would have been most valuable, or to the absence of experience.

So far as the American automobile industry is concerned, a striking failure is that of the standard specification for military trucks evolved by the U. S. A. govern-

ment officials during the early period of the war. It has been admitted by a prominent American that in the light of subsequent experience some of these specifications were ill-advised, but it must be remembered that at the time of their formulation their knowledge regarding military transport was very much smaller than it is now. The only personal experience which they had to work upon was that gained on the Mexican border, where the conditions were entirely different from those which prevailed on the western front. It was later found that some of the fundamental principles of those specifications were based upon incorrect premises, and when the United Sstates ultimately decided to participate in the general European hostilities they found their army in possession of some 2,400 trucks of entirely unsuitable design and construction, and they then had to call upon the big manufacturers to reorganize the whole system of transport.

Attempts to right matters were made during the year 1917, when proposals were put forward for the standardization of complete new designs by the war department, and although strong opposition to this was put forward engineers were invited to Washington and the designs commenced. From the first they were handicapped by, among other things, lack of competent direction and organization. The result was the production of certain models, only one type of which, I believe, ever found its way to France, where it was received with a considerable amount of indifference by the A. E. F. The mistake had been made of trying to force on the industry a design which it had not produced, without due regard to those who were to use them, and in the production of which design it is only fair to say that the S. A. E. was not in accord, its policy having previously been to standardize complete machines.

Notwithstanding the extent to which standardization had progressed in the states, it is interesting to note that the transport corps of the A. E. F. was required to keep no fewer than 57,000 noninterchangeable parts in stock, besides 13,000 sizes of bolts, nuts and screws; a formidable total, but infinitessimal in comparison with the conditions which existed in our mechanical transport department.

What Should We Standardize?

It might be well for us to consider a moment what we mean by industrial standardization. Do we mean the boiling down into one specification and design for each complete car or lorry of any given load capacity, or, what almost amounts to the same thing, the standardization of complete units from which assemblers may turn out finished vehicle? Or does it mean the careful examination and standardization of details and materials which have common functions to perform, no matter what type of vehicle is under consideration? The former would almost amount to the production of one type of car or lorry only, and would practically mean the standardization of the industry's output rather than the standardization of the materials used by the industry. It would put a scotch on progress and bring an end to that much maligned individual—the designer. I have known heads of concerns who would welcome the abolition of new designs on the alleged ground that all factory expenses have their origin in the drawing office; those are the men who will rush the technical staff into production before a design has been thoroughly digested. They will not recognize that alterations can be made on paper at much less cost than in wood or metal.

Does the British automobile industry desire standardization to be carried so far that all motor vehicles, no matter in what factory they are erected, resemble the continuous products of a sausage machine so far as their similarity to each other is concerned? I, personally, do not think so. The vehicle of individual design will always find a market, and the truth of this may be found on the boulevards of Paris or in Fifth Avenue, where there will always be found an appreciable percentage of distinctive British built cars occupied by discriminating users. We have a choice of assembling as the Americans do, and commencing a hopeless struggle to compete with them, or of being satisfied to continue to build vehicles which have an individual touch which appeals to a limited market. Probably we shall do best to take the latter course, but even so we cannot hope to succeed unless we apply modern methods of production. We may not be able to build vehicles in such large numbers as to enable us to compete in every market, but we can produce many commonly applicable details in large enough numbers to ensure getting down to rock bottom costs for a large number of details. This can only be effected if we agree among each other firstly, what may be included in those "commonly applicable" details, and, secondly, decide upon their design, materials, dimensions and limits.

A certain number of useful standards were completed before 1914, including the British standard fine thread, while other useful standards have been evolved during the past six years, including the most valuable efforts of the steels committee, and the resulting standards for wrought steels. The sizes of magnetos, and many others of special interest to the industry have also been dealt with. Much remains to be done, however, and it can only be carried out with the good will and united efforts of all who have any interest in the industry.

Difficulties of Italian Auto Manufacturers

While it holds true that considerable competition on the part of Italian manufacturers will have to be met, especially as regards low-priced cars, it is evident from developments which took place during the past year that the Italian automotive industry is very much handicapped.

A report made to the stockholders of the Fiat Motor Co. covering the year 1920 brings out the fact that millions of hours have been lost on account of labor meetings which were held during working time for the discussion of working conditions and which commonly deteriorated into political harangues. The metallurgical strike, followed by the general strike of railways, posts, and telegraphs, hampered operations in April. This was followed by time-consuming discussions of the national wages agreement. In September the workmen seized the factories. October was taken up by setting the plants into order again, and the output was seriously restricted. November and December brought some orders, but reflected the lack of confidence abroad in products manufactured during the occupation of the plants.

Domestic consumption has been restricted by exorbitant taxes laid on the industry and on private automobiles and because of the luxury taxes and war supertaxes. In addition, a law is impending which will compel registration of the names of stockholders in private companies. Investors are becoming less and less interested in requests from automobile companies for loans and increased capital.

Compounding the Combustion Engine

(Continued from Page 17)

struction. In the light of the past 10 years' experience, the Diesel engine has proved an efficient, reliable and thoroughly seaworthy prime mover, suitable for a large proportion of the total sea-borne tonnage. In 1920, of 364 ships launched of more than 2,000 gross tons each, 350, or 96 percent of the total number, required less than 5,500 i.h.p. of machinery per ship—in numbers 96 percent, and in tonnage 88 percent, coming thus within the scope of the oil engine on its present basis. It should be noted that in the last fiscal year ending June 30 steamships had increased 6 percent, whereas motorships had increased 50 percent.

Novel Electromagnetic Clutch Affords Elastic Drive

In connection with the development of the compound engine for marine purposes, and in order to provide any Diesel type of engine with speed flexibility equaling the reciprocating steam engine, there has been developed an electromagnetic clutch operating on an entirely new principle. This clutch furnishes a positive yet completely elastic drive brought about by a unique correlation of two oppositely applied forces, each producing powerful torques induced and brought under perfect control by the application of a very small amount of external electrical energy. The drive has no moving parts, and is rugged and simple in design and construction. It is small for its power and therefore capable of being built in practically any range of horsepower.

This new type of clutch transmits power entirely through air gaps and has no mechanical contact whatever between the driver and driven, eliminating wear and deterioration. It is capable of remote control and can be operated at any speed from zero to full engine speed; the torque may be varied at will from maximum to minimum. The power required to operate the clutch at full load is but a small fraction of 1 percent of the power transmitted. An outstanding feature of this clutch is that on direct drive or full speed it is magnetically locked, which insures perfect synchronism and no slip with an extreme increase in pull-out torque. At this and all times, in fact, the transmission has the "velvet touch" of an air drive and insures complete torque-wise isolation of the mass moments lying on the two sides of the clutch.

To aid in the comparison with the reciprocating steam engine, Fig. 2, has been developed, giving views of the steam plant in shaded background. Against it there is outlined the standard compound, two-engine, geared magnetic-clutch arrangement for the identical horsepower and speed.

Specific Cost Comparisons

A proposition worked out and submitted recently by a firm of naval architects is as follows: In a moderately high-speed tanker in the Atlantic service using about 4,000 shaft h.p. as compared with the ordinary Diesel such as has been specially cited above, there is a saving in weight of about 400 lb. to the horsepower, which would mean an extra earning capacity for the tanker of $120,000 a year. The comparison with a steam-driven tanker is still more favorable, because in addition there is the earning capacity due to the extra saving in tonnage of fuel oil required as compared with that used under the boilers, giving another item of $134,000 a year, added to which is $85,000 saving in the fuel item itself, making in all $220,000 to be added to the $120,000. This makes $340,000 or not far from the cost of the entire equipment, or a 100 percent dividend annually. The saving of personnel and subsistance, amounting to about $30,000, is an additional saving over steam.

As to the turbine-electric drive, a comparison with a recent installation of 3,000 shaft hp. for a 17-knot ship gives the following results:

Steam-electric propelling machinery		670 long tons
Weight per shaft horsepower		500 lb.
Weight Sperry compound and auxiliaries:		
2 lighting sets, etc.	70 tons	
Gearing and electric clutches for same propelled speed	15 tons	
		85 long tons
Tonnage saved and available for cargo		585 long tons
Weight per shaft horsepower of entire plant		63 lb.

There is also a saving of 28,590 cu. ft. of cargo space in favor of the compound geared drive with electric clutches.

These figures show, as compared with the compound combustion engines employed in two units as proposed, that this ship is using in addition to 350 to 400 percent too much fuel, 240 percent too much space for her propelling machinery, and 790 percent too much weight for her propelling machinery, besides having to rely upon one engine, one electrical generator, one motor and one set of control gear for reliability of operation.

Conclusion

In combustion engines the high-pressure principle is scientifically correct, having brought to the prime mover its choicest heritage, as stated, viz., the highest thermodynamic efficiency known. Broadly speaking, however, these various engines represent only the early stages of the development. The best of present embodiments is simple Diesels, though much refined as to certain details, are, generally speaking, extremely crude, their design is based on such a ridiculously small quantity of air per charge, and their material efficiency is too low to be tolerated. Further, very large structures are required to produce small powers.

American Cars Predominate in Peru

American manufacturers have obtained a virtual monopoly of the automobile trade in Peru, although European competition is again coming into evidence. During 1920 the United States shipped 1,276 passenger cars to Peru, as compared with 599 in 1919. The total number of American cars sold from 1907 to 1920 reached 3,565.

No automobiles of any kind are manufactured in Peru. The fact that American cars dominate the market is a guaranty for future sales, as most professional chauffeurs are used to driving American automobiles and naturally prefer the cars they are acquainted with; also, spare parts can be obtained more easily, as most cars in operation are of American origin; furthermore, traffic regulations favor the lefthand drive, the rule of the road being to the right.

Mexican Automobile Show in 1922

The automotive group of the American Chamber of Commerce at Mexico City has definitely decided to hold an automobile show in Mexico City from April 16 to 23, 1922. The show will be open to all dealers in the United States and Mexico, and to all makes of automobiles, trucks and tractors of all countries.

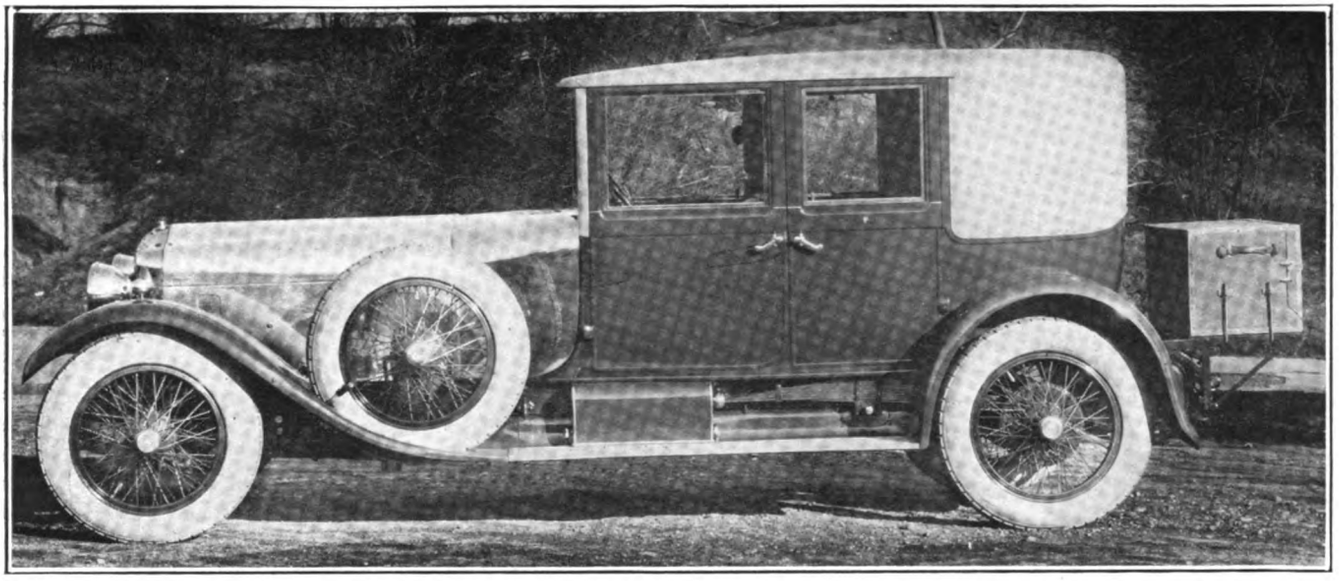
Ten automobiles of American manufacture have been imported into Poland by a Poilsh American company for use in a taxicab service for Warsaw.

Considerable Business and Many New Ideas at Auto Salon

First of the Season's Big Shows Brings Out Large Crowds, Sells Many Cars, Exhibits Number of Desirable New Developments.

YEARS ago, the Automobile Salon was purely an importer's display and people went to it predisposed in favor of the foreign product, both chassis and body, and conversely predisposed against the American product. Gradually, the importations have dropped off, the standard of American manufacturers has been raised and raised, both in chassis and body. Now people go to the salon to see the best American products alongside of a few of the best foreign products, and to admit the all-around superiority of former. Which is as it should be.

This year's salon, held in the Hotel Commodore, New York, Nov. 27 to Dec. 3, was a very successful affair. Starting with rather small crowds the earlier part of the week, the attendance built up quickly toward the end so that the total was unusually good, much better than the exhibitors themselves expected. This attendance too was a serious one, intent not so much upon the display as such, but upon picking out the best new car either for immediate or subsequent purchase. The net result of this was a very gratifying number of actual sales and a series of splendid prospect lists. Obviously, as all the cars were in the high price class—probably nothing in the show listed below $4,000—sales were not so great as they would be at a national or other show where some of the vehicles were below $1,000 in price.



Four-passenger sedan body by Brooks-Ostruk on Miner va 30 chassis for Miss Billie Burke. Blue and aluminum body and exterior, gray interior.

In a de luxe exhibition of this kind, for that is what the salon has now become, a partial and de luxe showing of some of the American cars, the general tone is of course conservative, but a number of new ideas were shown, most of them of obvious value. The body designs, which have always featured in this display, were up to or beyond the standard of previous years in richness, and not lacking in worth-while novelties.

Among the new ideas in chassis construction, that is mechanical details, the two chassis with eight-cylinder all-in-line engines appeared to give a multi-cylinder tendency, but when one considered that these two constituted most of the engines of that type in the world, which are being produced regularly and as a standard product, it appeared different. Similarly, there was noted several chassis with front wheel, that is four-wheel brakes, one of these being hydraulically operated. As a matter of fact, four-wheel brakes have acquired quite a vogue abroad, but have never been so well thought of in this country. Of the four which showed this feature, Isotta-Fraschini, Hispano-Suiza, Delage, and Duesenberg, the first three are all imported.

In the way of engines, there seemed a marked tendency toward high powers, coupled with unsually low weight, making a very expensive, high-powered job which would give surprising fuel, oil and tire economies. Thus, one of the Mercedes chassis was powered with a new six-cylinder airplane motor which was claimed to develop 95 horsepower, yet the entire chassis weighed but 2,800 lb., and with touring body but 4,100 lb. The Duesenberg was rated at 100 h.p., yet its weight complete with touring body was but 3,250 lb., so that the claim of 20 miles per gallon of fuel does not sound unreasonable. The Isotta eight was rated as better than 80 h.p., and its weight was given less than 3,500 lb. and its fuel consumption very small. The four-cylinder Duesenberg motor in the Richelieu is rated at 85 h.p., and the car speed in excess of 75 m.p.h., coupled with wonderful fuel economy.

And so it went right through the show, power ratings above 75, wheelbases longer than 130, maximum speeds above 75, and with all this economy above 15 mi. per gal.

Weight has been saved by better, more simple and neater design, by the rather free use of alloy steels machined at more expense perhaps but certain to give strength and safety with light weight, by the liberal use

of aluminum and magnesium alloys, and in other ways. Naturally, these more expensive materials, the greater expense in machining, and the expense of redesigning go with these higher-priced cars, when none of them would be possible in lower-priced jobs.

Engine design appears to be along more simple lines, so that engines appear more simple, even to the man without much mechanical knowledge. This has been accomplished by enclosing, in which case the simplicity and neatness is more apparent than real, and by better designing.

Contrary to the earlier closed body show, where disc wheels appeared to have largely replaced wire, even on the lowest priced vehicles, this show marked a decided preference for the wire wheel. On the 80 cars shown, 30 had wire wheels and only 5 disc wheels. Steel wheels totalled 6, but 5 of these were of one make, Fiat, while the other, S P A, is an Italian product also.

Among the very praiseworthy forward movements was noted a number of firms which are now working toward automatic lubrication of all chassis parts, so the driver or operator does nothing but fill a container with lubricant about so often, or this in combination with a simple, clean, once-a-week movement of a convenient hand lever. On the Richelieu and one other car, the Romon system was installed. This includes a small combination tank and oil pump, with about 14 leads to the various chassis parts. Once a week, the driver operates this by means of a small lever, a couple of backward and forward movements being sufficient. In this way the entire car is kept adequately lubricated. Mercedes showed a similar scheme with a foot pump at the driver's toe for forcing the lubricant around. Fergus is well known as the first advocate of enclosing springs with a leather boot, kept supplied with lubricant, from a central pump. The Pease job has an automatic lubricating system, similar to the Romon. Lanchester had a modified chassis lubricating scheme. Practically all the cars had the alemite or a similar method, but with long tubes extending out from the inaccessible places so as to make lubricating more simple and convenient. It would appear but a matter of a short time before automatic chassis lubrication will become nearly universal, so manifold are its advantages.

Passing to the body types and their details, the show as a whole revealed the American body builder as a master of his trade, and second to none in fine workmanship, good taste, selection of materials and lines, and in other ways. There were more enclosed bodies than ever before, reference being had in this to the partly collapsible forms as well as the entirely enclosed noncollapsible ones. The body builder seldom refers to the former as an enclosed body, but the term is used here to differentiate between the vehicle which is suitable for all-year use and the open touring car and its modified forms which are comfortable only through the summer months. In fact there was but one roadster, and only four large six or seven-passenger touring bodies, and nine four or five-passenger touring cars of the sporting type. These with the 6 chassis give an idea of the great predominance of enclosed bodies, all the rest of the 80 vehicles being in that class.

This last sentence brings out a rather new development, in that capacities are no longer being exaggerated as they were once. A small narrow touring body of the sporting type, with but two cross seats and no extra seats, is frankly called a four-passenger job. Similarly in the larger cars, made slightly longer and fitted with two extra seats, this year these are being called a six-passenger. In many cases, the rear seat has been divided into two parts by a middle partition and armrest, so that it was impossible to claim that three people could sit in it, this applying to a number of the enclosed cars. The idea was that cars are so universal now that it is no longer necessary to carry a great number of passengers. Consequently, those carried may be more comfortable, and this comfort has been catered to by giving greater seat width, by arm rests on both sides, by higher backed upholstery and otherwise.

In a general way, the bodies show a greater use of moldings, especially the newer rectangular moldings which are very smart and seem to be replacing the old half-rounds. Quite a large number of jobs have this molding running practically around the whole job, from radiator to radiator, even carrying it out in the sides or edges of the hood. Metal frames for windows are almost universal and permit a large light, with greater strength. Bodies have more and more metal pillars and other metal parts, the idea of their use being to reduce the width of the non-glass parts. Just the opposite of this tendency toward greater visibility is that pronounced use of a solid rear quarter on enclosed bodies. Of course the collapsible cabriolet, brougham-cabriolet, and bodies of that kind must have it, but new this year are the bodies similating the collapsible, which can not however, be opened. In these, and in a number of the sedans and broughams, solid or nearly-solid rear quarters were used. One maker explained that women who wish to smoke in their cars desire the greater privacy which this arrangement gives, and laid the tendency to this.

Fittings are neater and less obstructive, because body designers have recognized the need for them, and provided enclosed spaces for them, rather than leaving them to be added later. In a general way, they were about evenly divided between silver (or nickel) plated and dull-surfaced silver or nickel.

Smooth upholstery was the rule, there being very little shown with the old-fashioned pipes and half-diamonds. Practically all that shown was of the straight piped form, without buttons on the one hand and mainly on bodies of the sporting type, either open or closed, and smooth surfaced throughout without piping, buttons of other central fastening means, these being altogether on enclosed cars. Many vertically divided windshields were noted with the halves arranged to raise or lower separately. In the handling of extra seats, no attempt is made to conceal them, as it has been found that the total enclosure gathered more dust than the frankly exposed forms. In the extra seats too, the idea of greater comfort is emphasized again, these being more roomy, better sprung and upholstered, and arranged to swivel all around, or half way around.

Without going further into details, it was a splinded display of superior chassis, with unusual coach work, and the various exhibitors almost uniformly found it a very profitable display.

It is reported that the daily Miami-Nassau air service cannot be inaugurated on Jan. 1, 1922, owing to delay by the British authorities in extending official support. Consul Lorin A. Lathrop reports it is the understanding that under the Bahamas Air Service Act, 1921, reasonable delay will not impair the British company's rights.

New York Busses Have Very Successful Year

Fifth Avenue Coach Line Carries More Than Fifty Million Passengers for More Than a Million Profit—Almost Three Hundred Now in Use.

WITH the filing of its annual report for the year ending June 30, 1921, by the Fifth Avenue Coach Co., New York, it would appear that the increasing popularity of motor bus travel through prominent New York streets and avenues has finally brought to the company the prosperity which its efforts deserve, and has justified the faith of the earlier officers of this pioneer company that sooner or later the public would take to bus travel. The new report covering the last full year of operation, show that more than 50,000,000 passengers were carried, and that this huge patronage at the 10-cent fare, has brought the company a net income for the year of $1,117,725.73, which is an increase over the year before, up to now the best period in the company's history, of $332,943.94.

Following its many lean years, especially the early years when the annual deficit was close to a million right along, this profit will not be begrudged the company by anyone who has followed its whole history closely. The capital stock is unchanged at $50,000, but the various accounts have increased so that it is a four-million dollar business. No dividend was declared however, the profits being put into the surplus account which now stands at $2,719,579.94, despite $175,000 set aside for completing payments on the garage, $155,966.42 reserve for injury and damage claims, and $29,884.13 other reserves.

The big green busses have become a familiar sight in the metropolis, and the service which they have rendered, and are continuing to render, is now thoroughly appreciated not alone by New Yorkers but more particularly by out-of-town visitors as a wonderful way of sight seeing. As a means of transportation, they give an uncrowded, out of doors method of travel which is in marked contrast with the crowded, uncomfortable subways and elevated roads. The busses will not take more passengers than there are seats, and when all seats are filled, they stop only to discharge passengers. In addition, the attendants are courteous, intelligent and render real service to passengers.

These things have brought about the present heavy traffic, which has necessitated more and more rolling stock, until now the total approaches 300. Difficulty in buying just the size, kind and type of bus desired has gradually brought forth more and more manufacturing factilities, until today the company is manufacturing busses to sell to other companies, a large number, more than 30, having been sold recently to a company in Toronto, and another equally large number to a company in a western city.

The income mentioned has been secured through the operation of 289 busses carrying a total of 51,091,365 passangers over 9,191,825 omnibus miles.

This increase in income has been secured, too, despite the fact that total maintenance for the year has increased $36.957.46, the total being placed at $844,651.11.

Analyzing the company's operations during the year it will be seen that the total amount of fares per bus mile was placed at 55.58 cents, which compares with 48.37 during the year preceding. Maintenance per bus mile went from 9.18 a year ago to 9.19 for the year just closed. Always an important factor in contributing to maintenance costs tire expenses dropped considerably during the year. Per bus mile this item amounted to 0.87 as compared with 0.98 during the year preceding, and is even lower than tire costs for 1919 which were placed at 0.95 per bus mile.

With the total number of passengers carried showing an increase of 8,538,656 over 1920 it will likewise be seen from the report that the company felt the need of expanding its equipment to provide for the increasing demands upon its service. Accordingly the year saw 18 new busses added to the company's fleet. Results of necessary expansion are also disclosed in the payroll which totaled $2,416,-930.93, representing an increase over 1920 of 367,248.80.

Illustrative of the scientific manner in which this large fleet of busses is handled in its various routes which lead through some of the most congested sections of the city is the fact that only three fatalities marred the year's record with serious injuries numbering 27 and minor accidents totaling 782.

Three-Joint Propeller-Shafts Standardized

The use of larger and heavier motor trucks during the last few years for hauling miscellaneous kinds of freight has resulted in lengthening the wheelbase to such an extent that an additional support at or near the center of the propeller shaft has become necessary. Propeller shafts so supported are known as three-joint propeller shafts since three universal joints are used, one at the transmission, one at the differential and one at the central support. Increasing use of this type of drive has resulted in a great number of different designs for the rear end of the forward shaft on which the center bearing is mounted.

Realizing that the three-joint propeller shaft has been in use long enough to warrant standardizing the rear end of this forward shaft, the Society of Automotive Engineers was requested to undertake this work. The subject was assigned to the truck standards committee and a subdivision consisting of J. R. Coleman of the Selden Motor Truck Co., H. B. Knap of the Packard Motor Car Co., and J. W. B. Pearce of the Spicer Manufacturing Co. was appointed to obtain information on present practice and to prepare a tentative standard.

A progress report was submitted by this subdivision in April, 1921, and it was discussed at the truck division meeting at that time. It was the consensus of opinion of the truck manufacturers represented that the adoption of a standard for the front-shaft rear shaft-ends was most desirable and would result in a considerable economy in manufacturing, assembling and servicing. A final report was therefore prepared and it will be considered at the S. A. E. standards committee meeting to be held in the Engineering Societies building, New York City, on Jan. 10. The proposed standard is, of course, still open to revision and it is suggested that anyone interested in it should review the report to ascertain whether or not it is feasible to incorporate the recommended dimensions in future designs.

Body Builders' Show to Hold Prize Contest

At the Body Builders' Show in the Twelfth Regiment armory under the auspices of the National Automobile Body Builders' Association, the manufacturers and their agents, the automotive engineers, the purchasing agents, the designers, the transportation managers, the municipal executives and all others vitally interested in the manufacture or use of motor vehicles will have an opportunity to see the most complete assortment of body types ever assembled under one roof.

Beside the passenger bodies shown both in finished condition and "in the white," there will be a full line of commercial vehicles, including dumping bodies, light and heavy panel bodies and omnibus bodies.

One of the attractive features will be the prize contest among body designers for which the management has appropriated $500 in cash for prizes.

More than 40 of the leading automobile body designers have already registered and the following are to serve as the committee of awards: William Brewster, Brewster & Co., New York; Ernst Schebera, vice president Fleetwood Metal Body Co.; Charles Heergeist, technical editor Vehicle Monthly; John Graham, president Holbrook Co.; Andrew F. Johnson, formerly head of the school for carriage draftsmen, Gray, Me.

The conditions of the contest are as follows: This contest is open to individuals in the body engineering and designing profession, and all are invited to participate.

Five hundred dollars divided into first, second and third prize money will be awarded to the three submitting the best designs.

The awards, including also honorable mention, will be publicly announced and sent to the press on Tuesday evening, Jan. 10.

Thereafter for the entire week of the show every design will continue on exhibition, labeled with the name and address of its maker.

Body builders may enter designs only under the name of the designer, but such of these designs as receive a prize of honorable mention will have a second label giving the name of the firm.

Specifications

Designs must be drawn either in ink or colors on white bristol or mounting board; size not to exceed 22 x 28 in.

A symbol is to be placed on each design. This symbol must not suggest the identity of the designer or the firm by whom he may be employed. Designs not observing this rule or containing any other marking will be rejected.

The design must illustrate a complete car with a body that will accommodate four or more passengers. The awards will be based on the merit of the body design itself, its fitness for the selected chassis and its practicability. The body must fit some one of the chassis used in substantial quantities by any automobile manufacturer. Changes may be made in the radiator, bonnet, fenders, etc., but the body mounting dimensions must remain standard.

Each one who participates must mail in a plain white envelope a slip of paper containing a copy of the symbol placed on his drawing and his name and address at the time he tenders his design. If submitted by a body builder it must also contain the name and address of the firm. The paper must also contain the make and model of chassis for which the body is intended. These envelopes must be addressed to the Body Builders' Exposition Co., Inc., 1819 Broadway, New York City, attention of chairman of the committee on awards.

In order to provide for proper exhibition of these designs each one who anticipates participating must register, stating the number of designs that he intends to exhibit.

Among Those Who Will Exhibit

Accessory Forgings Co., Detroit; American Chemical Paint Co., Philadelphia; American Cushion and Spring Co., Kalamazoo, Mich.; Amesbury Specialty Co., Amesbury, Mass.; Arkle Lumber and Mfg. Co., Brooklyn; D. L. Auld Co., Columbus, O.; H. H. Babcock Co., Watertown, N. Y.; Bender Body Co., Cleveland; Charles C. Blackmore, Dayton, O.; A. Boyriven, New York; Brewster & Co., New York; Bridgeport Coach Lace Co., Bridgeport, Conn.; J. G. Brill Co., Philadelphia; Brunsene Co., Watertown, Mass.; A. S. Campbell Co., Boston; Cleveland Hardware Co., Cleveland; Dictograph Products Corp., New York; W. H. Duncan Co., Inc., New York; Dura Mechanical Hardware Co., Toledo; Eagle-Ottawa Leather Co., Grand Haven, Mich.; E. V. B. Mfg. Co., New Haven, Mich.; FitzGibbon & Crisp, Inc., Trenton, N. J.; Hamilton-Wade Co., Brockton, Mass.; Haskelite Mfg. Corp., Chicago; Highland Body Mfg. Co., Cincinnati; Holbrook Co., Hudson, N. Y.; Hume Body Corp., Boston; The Laidlaw Co., New York; Martin-Parry Corp., Indianapolis; Methet and Perry, East Orange, N. J.; Metropolitan Body Co., Bridgeport, Conn.; Metallograph Corp., New York; Milburn Wagon Co., Toledo, O.; Mitchell Specialty Co., Philadelphia; Newman Commercial Body Co., New York; Nurre Mirror Plate Co., Bloomington, Ind.; Joseph F. O'Brien Mfg. Co., New York; Pantasote Co., New York; Radel Leather Mfg. Co., Newark, N. J.; M. Rawle Co., New York; R. E. Roderiguez, New York; Seamans & Cobb Co., Boston; Smith-Springfield Body Co., New York; Soss Mfg. Co., Brooklyn; Stengel & Rothschild, Inc., Newark, N. J.; E. J. Thompson Co., Pitsburgh; Trico Products Co., Buffalo; Valentine & Co., New York; Waterloo Body Co., Waterloo, N. Y.; C. A. Willey Co., New York; Willoughby Co., Utica; York Corrugating Co., York, Pa.; Zapon Leather Cloth Co., New York; Zenite Metal Co., Indianapolis.

Cost of Motor-Vehicle Operation

What it costs the government to operate motor vehicles engaged in road building is shortly to be determined through a system of operative records recently installed by Bureau of Public Roads, Department of Agriculture.

Out of the surplus war material turned over by the War Department for distribution among the states, the bureau has retained a large number of motor vehicles, which are used principally on forest road work in the west. These motor vehicles are kept at various central points where shops are maintained for repair work.

Complete records will be kept of all oil, gasoline, and supplies of every kind used by each vehicle. Even the number of tube patches will be kept. Record will also be kept of the number of hours of shop work required; of days idle, and why; of distances loads are carried and the character of the loads; and the gross income from the operation of the vehicles. The information thus obtained will be combined with similar information from some of the states operating the surplus war equipment turned over to them, and will form a valuable addition to the knowledge of the cost of highway transport.

Preliminary Data Indicates 10,500,000 Cars in Use

Recent Statistics, With Estimates to End of 1921, Indicate That Number of Motor Vehicles Is Up to Predictions

RETAILED figures for the last two years (1919 and 1920) have indicated a net addition to the number of motor cars and trucks in use of approximately 1,650,000 each year. Preliminary figures of 10,487,617 which are now available through that excellent financial newspaper, the Boston News Bureau, indicate that 1921 has kept right up to that average. Recently, the National Automobile Chamber of Commerce estimated that 1,700,000 cars had been manufactured and sold in 1921, which agrees rather closely with these new figures now available, and with earlier estimates.

According to the survey made by this paper, New York leads the states in total, with 860,446, which compares with 670,290 at the end of 1920. This is the biggest increase (190,156) the state has ever shown and in percentage (28.4) is well above last year (18). Ohio is placed second with 722,000, an increase of barely 100,000 as compared with last year's 110,359, while Pennsylvania is again third with a total of 703,000. This is an increase of 132,836, and thus far above 1920 when the gain was but 88,047.

Illinois, the third most populous state, is well up to the front in point of motor cars. It expects to have 660,000 registered by the beginning of the new year, or one for every 9.8 persons. California, the tourists' paradise, does not lag far behind with 644,356 cars actually registered up to Oct. 20. The automobile density in California is near to the highest in the country, with a car for every 5.3 persons.

Iowa continues to lead in point of cars per thousand of population. This state expects to have 465,000 cars registered by the end of the year, or one for every 5.17 persons. If all its cars and trucks were mobilized, the entire population of the state could "go aridin'" at once. The showing of the middle western states as a group is high, there being a car for every 7.7 persons. But the western states and particularly the states of the Pacific slope hold the palm for automobile density. In the group comprising California, Washington, Oregon, Idaho, Utah, Arizona and Nevada there will be by New Year's a car for every 6.2 persons.

In the New England states, a thickly settled region, rich in resources, with good transportation facilities, but noted for conservatism, there will be by the turn of the year a total of 654,737 cars registered, or one for every 11.3 persons. For the eastern states, New York, New Jersey, Pennsylvania, Delaware, Maryland and the District of Columbia, there will be 2,068,246 cars registered, but the average in relation to population is a trifle lower than in New England, with a car to every 11.8 persons. Both of these sections are slightly below the showing for the country as a whole.

The south has bought lavishly of automobiles in the last five years. The increase has been relatively greater than for any section of the country. High-priced cotton and resulting prosperity constituted a powerful contributing factor. But even so the automobile density of the south is lower than in any other section of the country, there being only one car for every 15.8 persons, which is much below the average of the country.

Turning from a bare examination of the figures to a search for the causes back of them, some further facts are developed. It is found that other things being equal, motor absorption per thousand of population is bound to be less in the great centers of population, in the congested industrial districts, than in prosperous rural communities. In the cities other means of rapid transit are quickly and easily available. Here there is concentration of wealth, but also concentration of poverty. To the western large-scale farmer where the distances are great and the cities less accessible, the motor is well nigh indispensable. Development of good roads has played a most important part. Such factors, plus purchasing power, account, to large degree, for the motor density in Iowa, Kansas, Nebraska, the Dakotas and states of the Pacific slope.

There is a well defined relation between statistics of wealth, such indices of purchasing power as are available in the different states, and the motor density. The personal net income reported for the different states under the federal income tax returns of 1919 furnish a valuable and interesting guide. The wealth statistics of the states under the last census will not be available for a year or two, but 1912 census figures, although now doubtless greatly exceeded in all cases, nevertheless furnish a guide to the relative purchasing power of the different sections of the country. The 1919 income tax returns, which are available in detail, in conjunction with the wealth statistics, at once indicate why motor distribution in the southern states is relatively far less per thousand of population than in other sections and is much below the average of the country as a whole. The south has made great strides in the last two decades agriculturally and industrially. The civil war left a trail which it took many years to obliterate, but the renaissance is long under way. Probably that section presents larger possibilities of further development than any other great section of the country.

In some of the southern states the motor distribution is quite thin in relation to population, judged by standards of other sections. In Alabama, for example, there is only one car for every 28.5 persons. Louisiana has but one for 27.2, and in Arkansas the ratio is one to 26.1. The average for southern states is a car for every 15.8 persons.

The average personal net income per return does not differ very widely for the various states but applying the net taxable income per capita gives quite different and striking results. For instance, in Alabama the personal net income was $57 per capita as applied to the 2,348,174 population. In Louisiana it was $112, in Mississippi $56 and in Arkansas $70. Contrast this, for example, with $330 per capita in New York state; $283 in Massachusetts and $380 per capita for the District of Columbia. In Iowa it was $219 and in California $286. The figures in the south suggest the much larger relative proportion of the population which escaped the federal income tax with its $1,000 exemption for single men and $2,000 for married men, etc.

On the basis of wealth statistics of 1912 the indications are similar. The wealth of Alabama was given as $2,127,054,930, which would be equivalent to $906 per capita on the 1920 population. In Louisiana it was $1.203 per capita;

in Mississippi, $751; in North Carolina, $706; in Tennessee, $821; in South Carolina, $803. The wealth of New York state was $2,408 per capita; Massachusetts, $1,636; Iowa, $3,273; Kansas, $2,608; Nebraska, $2,927; California, $2,469. The wealth of the group of southern states was $35,540,124,990, or but $1,097 per capita. For the New England states it was $1,595 per capita; eastern states $2,046; middle western states, $2,014; western states, $2,486; Pacific group, $2,329.

The time may be far off when the country will have 20,000,000 cars, which would be almost double the present number, the analysis of the News Bureau shows. But a registration of 15,000,000 passenger and commercial cars within the next half dozen years is by no means an impossibility, it is felt by this paper.

Average figures are, of course, to some extent misleading. There are, for example, many people who own more than one car. The number of such is not ascertainable from registration figures. Out of the total cars there are now considerably over 900,000 trucks. By the end of the year there may be close to a million, which would constitute nearly one-tenth of the anticipated automobile registration on Dec. 31 next.

It has been calculated that the average life of a car is about six seasons. With 10,487,000 cars registered by the first of the year, there would be a renewal demand for about $1,748,000 cars per annum. With 15,000,000 cars in use there would be a replacement demand of 2,500,000.

Passenger Car Body Standardization

Five definite recommendations covering body standards have been formulated by the passenger car body division of the Society of Automotive Engineers and will be acted upon at the January meeting of their standards committee. These recommendations are contained in the first report of the division which was appointed early in 1921 by the council of the society with a personnel representative of body manufacturers. The recommendations cover proposed standardization of door-handle squares, door-fit clearances, punching of holes for electric wiring, wiring for beads and body nomenclature.

The recommendation for door-handle squares specifies 5/16-in. square key-stock with tolerances of plus or minus 0.001 in. These tolerances are specified by the division as they are considered necessary for good engineering practice and are used by several consumers in key-stock. Two types of door-handle squares are included in the recommendation, the externally-threaded type and the internally-threaded type. A ¼ in.-28 S. A. E. thread is specified for the externally-threaded type and a No. 10-32 U. S. F. thread for the internally-threaded type.

The recommendation for door-fit clearances is ⅛ plus and minus 1/32 in. for the hinge side and top, 3/16 plus 1/16 and minus 0 in. for the lock side and jamb, ¼ plus 1/16 and minus 0 in. for the bottom and 3/32 plus 1/32 and minus 0 in. for the bead. These clearances are for all types of body and are measured from wood to wood or metal to metal before painting. The division also recommends that door-flange widths shall be 5/16 in. on the hinge-pillar side and ½ in. minimum on the lock-pillar side and on the bottom. The door-fit tolerances specified do not apply to the flush type of door according to the report.

The division recommends that where holes are punched in sheet metal for carrying grommets or bushings, particularly when these are made of rubber, they shall be necked. This recommendation is made so as to minimize danger of cutting electrical wiring on conduit.

In order to simplify the manufacture of sheet-metal parts in which a beaded construction is used such as fenders, and splash guards and to economize on the number of sizes of wire used the division recommends that for engine hoods up to and including 36 in. long, top-hinge rods shall be 5/16 in. diameter and side-hinge rods shall be ¼ in. diameter and that for fenders, aprons and splash guards the wire used for beading shall be No. 11 b. w. g. bright basic steel wire.

The subject which has probably taken up most of the time of the division during the past year is the recommendation on body nomenclature. This work was undertaken as it was appreciated that the great variety of names applied to given types of body is confusing to passenger car purchasers. A subdivision was therefore appointed to formulate a tentative nomenclature for automobile bodies which has been considered at several meetings. The names of the bodies finally determined upon for standardization are: Roadster, coupe, phaeton, sedan, berline, limousine, brougham, landaulet, cabriolet, sedan-landaulet, berline-laundaulet, coupe-landaulet, limousine-landaulet and brougham-landaulet. Another type is to be included in the nomenclature, the name not having been decided upon at the present time. The name will be descriptive, however, of an enclosed single-compartment body with two fixed cross-seats, close-coupled and allowing the minimum fore and aft seating space for four passengers.

The conventional body has four doors and may have removable glass side windows in the doors only, with solid rear quarters or the quarters may have small removable or fixed windows.

The name of a body that bears the same relation to the type of body described as the sedan-landaulet does to the sedan will also be included in the report before it is finally acted upon at the standards committee meeting on Jan. 10 at the Engineering Societies building, New York.

In developing this nomenclature it was found that there was a great difference of opinion regarding the advisability of specifying the word phaeton or touring when applied to an open-type body with two fixed cross-seats for four or five passengers. The principal reason for recommending the use of the term "phaeton" instead of the term "touring" is that the latter has lost all of its significance as applying to any particular type of body, all types being used for touring. The term "phaeton" is used extensively in Europe and to a considerable extent in America in connection with passenger cars; it is the name of a horse-drawn prototype; it is inelegant and in a technical sense is not distinctive of any particular type of motor-vehicle body. It would seem therefore that the division had made a desirable step in recommending the use of the word "phaeton" instead of "touring."

The passenger car body division has recommended that other national organizations such as the National Automobile Chamber of Commerce, the American Automobile Association, the Automobile Body Builders' Association, the Carriage Builders' Association and the Vehicle Manufacturers' Association, as well as the automobile press, should give the recommendation, when and if finally approved by the society, their support by urging upon all manufacturers and distributors of automobiles the desirability of adhering to the standard nomenclature.

Power Press and Die Development Due to Auto Industry

BY HENRY J. HINDE*

Economical Production of Motor Cars Made Possible Through Ability to Control Flow of Sheet Metal Into Certain Forms and Shapes

THE art of producing sheet-metal stampings from a flat sheet while cold has made marked progress in recent years, and many articles are now made of sheet metal which were formerly produced by casting or forging, or in a lathe, milling machine, drill press or at the bench.

Forming and stamping operations especially have in many classes of work become very complex, and the art of drawing sheet metals, stimulated by the enormous demand of the automobile industry in particular, calling for most intricate shapes, has reached a state of perfection hardly imagined possible a few years ago. The results achieved by the ingenuity of the present-day press and die designers, and to no small degree also by the metallurgist, who comes into consideration through his improvements of the physical qualities of the metals used, are indeed revelations in economy of production, strength of stamped articles and the absolute interchangeability and beauty of appearance of the finished products.

The development of power presses, together with that of dies and special tools, has been so marked in the last 12 years, principally because of the demand for intricate stampings for the automobile trade, that it is believed a far greater advance has been made than at any other period in the history of the business. This development has not wholly been confined to the working of sheet metal, for, as previously stated, the demand for accurate duplication of parts and the great quantities in which they are desired has resulted in power presses being used for sizing forged steel parts which were formerly finished by means of saddle milling and similar operations. It has been found that manufacturers can produce greater quantities with much greater accuracy and with such a reduction in machine shope production expense by the use of what is known as knuckle-joint or cold-swaging presses in sizing the finished working surfaces on these forgings, that a number of equipments have been installed for work on steering knuckles, brake levers, connecting rods and other similar forgings and castings. These presses are built in sizes capable of exerting a pressure up to 2,000 tons and over, and it is claimed that size limits of 0.001 in. can be successfully maintained in operations of this character.

Although this marked advance is due to the automobile industry more than to any other one factor in recent years, at the same time the economical production of motor cars was made possible solely on account of the ability of the press and die manufacturers to successfully control the flow of the cold sheet metal into certain forms and shapes, by means of properly constructed dies and presses of such power and design that wonderful results have been obtained. As an illustration let us take a wire-wheel hub.

This hub requires a blank 16½ in. diameter and 5/32 in. thick. Attention is called in particular to the numerous niches or pockets successfully formed into the circular shape, and also to the fact that the stamping was first drawn to a considerable depth at the narrow neck. The end of the neck or bottom of the stamping was then removed and this metal was made to flow back and expand to a considerable degree beyond its former small diameter without even stretching or thinning the metal in the reforming operations, thus proving conclusively how successful the metal was controlled and forced to flow back into its larger diameter with an opening in the bottom much smaller than the former smaller diameter of the neck of the stamping.

In the production of brake drums, front and rear hubs and spoke flanges the conditions that have to be fulfilled by the dies are that the product shall be absolutely interchangeable; that no machine work shall be performed upon the stampings when coming from the press, excepting some reaming and thread cutting, and that the strength of the material shall remain unimpaired. In addition it is imperative that all cylindrical parts be smooth and true and of standard diameter, allowing less than the commercial tolerance of variation. The work involves a most careful planning of the interrelation of the several operations, so that at no time the material shall be overstrained or reduced in thickness, and that the dies shall not be subjected to excessive wear in order to maintain uniformity of sizes.

A straight-column press has been developed especially for such work by the Toledo Machine & Tool Co. which is of unusually rugged proportions and weighs about 145,000 lb. It is double-geared with a ratio of 40:1 and fitted with a very powerful friction clutch in combination with an effective brake and hand-lever control, so that the machine may be started or stopped at any part of the stroke of the slide up or down. The frame consists of four pieces—the bed, the two uprights and the crown—which are held together by four massive tie rods passing through the said crown, uprights and bed. When the frame is assembled these tie rods are heated. The nuts are then screwed home and the rods permitted to cool. In this manner, through the tendency of the rods to shrink, an enormous pressure is exerted by the rods upon the frame that renders the entire structure practically an integral one and brings all the working stress upon the tie rods.

Axle housings are made of steel plate up to 5/32 in. in thickness, and the requirements are that the stampings be perfectly straight and flat so that when the two halves of the housing are joined together by welding they form a perfect casing without warp. A powerful double-crank press developed for this purpose weighs about 95,000 lb. and is capable of forming and stamping cold at one blow axle-housing halves about 40 in. in length of steel plate up to 5/32 in. in thickness, the blank having been cut previously to proper shape.

One modern form of toggle drawing and deep-stamping press, such as is used for making engine pans, radia-

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tors and other similar articles of the comparatively lighter gages of metal, has two slides, an outer slide for clamping the blank and holding it while the work is being drawn, and an inner slide for doing the drawing, stamping and forming operation. Presses of this character are also made in the double-crank type with a considerable distance between the uprights and weighing as much as 600,000 lbs. Such presses are used for body forming, for making cowls, dashes, fenders, etc.

The forming of channels and side rails for automobile frames and similar requirements has resulted in the designing and building of special presses particularly adapted for this work. The side rails, for instance, are preferably first blanked in a double-crank press as much as 218 in. between the uprights. The largest sizes of these presses weigh in the neighborhood of 500,000 lb.

The forming operations are performed in a specially designed press, the outstanding feature of which is that the operation is diametrically opposite that of the ordinary toggle drawing or deep-stamping double-action presses. The channel-forming press has a movement entirely mechanical that brings the tools down and at rest on a flat blank, or sheet, by means of a toggle motion, and in this position the machine is capable of a resistance pressure upward of 2,000 tons. While this first toggle movement is at rest, another movement is brought into play, forming up the sides of the channel or frame. The machine in its operation completes the one cycle when the stamping lies on the face of the dies completely formed, with the result that the web, or bottom of the stamping, remains as flat as it was in the original sheet. In other words, the bottom or web of the channel is held perfectly flat during the operation. Several of these presses have been built and are in most successful operation. They weigh upward of 600,000 lb. each. One of these presses with five men will do the work of three hydraulic presses with 15 men, to say nothing of the large force required to straighten the rails when hydraulic presses are used.

Still another interesting feature that the automobile trade has developed is the smoothing-out process for certain of its stampings, more particularly the tapered, stamped-steel radiator front or casing. Because of its slightly tapering form it was found difficult to produce a stamping for this piece so free from waves, or buckles, that it would show smooth over the finally enameled and varnished surface. The requirements were successfully met by developing a set of tools to receive the finished stamping and allow an exceedingly small space for water to flow just inside of the stamping around the steel form supporting the stamping. It was necessary to exert a pressure of some 2,000 tons on the outer surface of the stamping to prevent steepage or leaking, and to supply water to the die through a ¾-in. pipe by means of an accumulator with sufficient force to smooth and iron out the unevenness and waves in the original stamping.

Official figures recently published in the Japan Advertiser show that there are 5,728 licensed motor cars and 98 auto trucks in Osaka, the automobiles averaging one car for every 218 citizens of Osaka. There are also 47,396 licensed bicycles and nearly 6,000 rickshas.

General business is languishing in Johannesburg, but there is an upward trend in the demand for motor cars, with country districts displaying more interest.

Speedings of Grinding Wheels

In general, a soft grinding wheel revolving rapidly permits a higher production than a hard wheel revolving more slowly, states a recent issue of "Grits and Grinds." This is true because the more open structure of the soft wheels provides greater clearance for the grinding chips, which results in a freer and cooler cutting action. Theoretically, therefore, the correct speed for grinding wheels is the safe maximum speed at which the wheel may be operated. In actual practice, however, certain ranges of peripheral speed may be found to give good results on certain classes of work. For example, a satisfactory wheel speed for sharpening wood-planer knives is around 3,500 surface feet per minute; for cylindrical grinding of crankshaft pins and bearings, around 6,000 surface feet per minute; and for cutting off hardened and high-speed steel tubing, and the like, the proper speed approximates 9,000 to 10,000 surface feet per minute. The following conclusions are reached regarding grinding operations:

1. The grade of hardness to be recommended for a grinding operation depends on the surface speed of the wheel. 2. The grinding wheel should be as soft as is feasible for the operation, and whenever possible operated at the high end of the recommended range of speeds. 3. For a given wheel used for precision grinding operations, not much increase in production is to be expected from increasing the speed of the wheel alone. 4. The logical way to increase production in precision grinding operations is to increase the traverse of the work past the wheel or the depth of cut of the wheel.

Hercules to Enter Motor Car Field

The Hercules Corp., Evansville, Ind., will enter the motor car production field early in 1922 with the "McCurdy," a 6-cylinder car with standard parts and a wheelbase of about 126 in. It is hoped that it will be in readiness for spring delivery.

The Hercules Corp. has long been known as one of the largest industrial establishments in its line, that of the making of buggies and carriages, gasoline engines and bodies for trucks and commercial cars. It started 31 years ago in Cincinnati, but moved to Evansville about 20 years ago, and has advanced to the position of one of the largest industrial establishments in Indiana.

It has a record of having produced in one year 84,000 buggies and carriages, 62,000 gas engines and 40,000 bodies for trucks and commercial cars. Its factories cover 31 acres and its sales organization is represented in every part of the country and in Canada, Mexico, Central and South America, and Europe. Last year's sales are said to have exceeded $12,000,000.

Col. W. H. McCurdy, head of the corporation; J. D. Crafts, general manager; Lynn McCurdy, son of Col. McCurdy and vice president of the concern; and Gard Gale, sales manager, have spent a year in the development of the "McCurdy," which has been evolved from the "Gale," a car designed by Garde Gale and exhibited at the 1920 March Indianapolis automobile show. Both Gale and Lynn McCurdy have long been identified with the automobile industry, McCurdy having served as head of a motor transport division during the war. Detailed announcement of the specifications of the car is not yet ready.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Super-Traction Truck Co., Fox Lake, Wis., a $300,000 corporation organized a year ago and now manufacturing six-wheeled motor trucks in leased quarters, is negotiating with the Industries Bureau, Association of Commerce, Fond du Lac, Wis., with a view of establishing permanent works in that city. J. M. Gooding has been appointed chairman of a special committee to conduct investigation. D. G. Strobel is manager of the Fox Lake concern.

Stoughton Wagon Co., Stoughton, Wis., has decided to remodel the manure spreader department of its works into a motor truck factory to provide facilities lost through the burning of the truck shop early in November with a loss of $250,000. This will be a temporary measure, for the company expects to start work in the spring on a fireproof building for the motor truck division. F. J. Vea is president.

Templar Motors Co., Cleveland, sustained a fire loss on Dec. 13, destroying property valued roughly at between $250,000 and $300,000. The main fireproof plant was the only structure untouched by the fire. All other structures were burned to the ground, including the old main plant, a frame structure composed of three buildings in which parts were stored.

E-Z Collapsible Rim Co., Conneaut, O., has increased its capital stock from $10,000 to $1,000,000 and plans to increase its facilities for manufacturing automobile rims. It is reported that the company has under consideration the addition of a drop forge plant. W. T. Manning is president, and Frank Haefner, secretary and treasurer.

Willys-Overland Co., Toledo, O., will move its Willys-Knight motor assembling plant from Elyria, O., to Pontiac, Mich., where production will be concentrated, owing to the fact that motor castings are being made at the plant of the Wilson Foundry & Machine Co. in Pontiac. The Elyria plant will be used for other purposes.

Doble Motors Corp., Call building, San Francisco, Cal., manufacturer of steam-driven automobiles, is negotiating with the Chamber of Commerce, San Mateo, Cal., with view to building a new plant in the Burlingame section, estimated to cost $300,000, including machinery. G. H. Landfield is representing the company.

Triumph Motor Truck Co., Medina, N. Y., manufacturer of assembled motor trucks, has acquired property at DuBois, Pa., for a second plant, to be operated in conjunction with the Medina works. Plans will be prepared at once and it is expected to have the works ready for service early in the year.

Signal Motor Truck Co., Detroit, has been reorganized and will continue to manufacture trucks under the name of the Signal Motor Corp. The officers are: President and treasurer, M. B. Hoagland; vice president, H. S. Sternberg; secretary, H. H. Emmons, and assistant treasurer, J. C. Dibsball.

C. H. Wills & Co., Marysville, Mich., have taken over the branch plant in Marysville of the Illinois Tool Co., which has been devoted exclusively to the manufacture of steering gears, speedometer drives and accessories for the Wills company. No changes except in personnel will be made.

Muellers Metals Co., Port Huron, Mich., has received an order from a Detroit automotive manufacturer for brass parts amounting to $525,000 and states that future orders for replacements will probably bring it up to $750,000. The contract term is from Nov. 1, 1921, to Nov. 1, 1922.

Penn Motors Corp., 1714 N. Broad st., Philadelphia, Hilton W. Scofield, head, will take bids at once for its one-story automobile manufacturing plant at Pleasantville, N. J., 50 x 300 ft., with powerhouse. Charles H. Donehower, Pleasantville, is engineer.

California Car Co., Richmond, Cal., is completing negotiations with the city officials at Martinez, Cal., for a plant to manufacture automobiles and parts, estimated to cost close to $100,000. It will give employment to about 250. A. D. Bowen is president.

Morand Cushion Wheel Co., 818 S. May street, Chicago, manufacturer of automobile wheels, will soon call for bids for the erection of a two-story plant at Western avenue and 77th street, estimated to cost $500,000, including machinery.

Sheldon Axle Works, Wilkes-Barre, Pa., manufacturer of automobile axles, sustained a fire loss Dec. 7 estimated at about $75,000. The forge shop was practically ruined. The company is a subsidiary of the Spicer Mfg. Co., Plainfield, N. J.

Ruggles Motor Truck Co., Saginaw and Bad Axe, Mich., will take over the plant of the defunct Bollstrom Motors, Inc., St. Louis, Mich., and operate it in conjunction with the wheel plant of the Ruggles company in Alma, Mich.

Willard Storage Battery Co., San Francisco, is having plans drawn for a two-story building at Second and Stillman streets estimated to cost about $40,000. O'Brien Brothers, 240 Montgomery street, are architects.

Beaver Truck Corp., Hamilton, Ont., has taken over the plant and business of the Beaver Motor Truck Co., and will built an addition to cost $50,000. It proposes to produce a new model truck of 1¼ tons.

E. W. Bliss Mfg. Co., St. Clair avenue, Cleveland, manufacturer of presses and other machinery, is planning for the erection of a one-story forge shop, estimated to cost about $42,000.

Duty Motor Corp., 19 N. Spring street, Elgin, Ill., has let a contract for a one-story plant, 250 x 250 ft., for the manufacture of automobile trucks; estimated cost $80,000.

Dearborn Truck Co., 2515 W. 35th street, Chicago, has let contract for a one and two-story addition, 60 x 400 ft., to its plant at Cicero, Ill., to cost $80,000.

Curran Motor Radiator Co., 401 Calvert building, Baltimore, will soon take bids for its one-story plant, 40 x 180 ft., estimated to cost about $30,000.

Buick Motor Car Co., Flint, Mich., has taken out a permit for the erection of an addition to No. 1 plant, at a cost of $97,000.

Body Builders

L. C. Graves Co., Springboro, Pa., manufacturer of commercial car and truck bodies, has purchased the Moore Motor Co. plant and will operate it under the name of United Automotive Body Co., Danville, Ill. The new company will be capitalized at $1,250,000 and will employ 500 men. It will embody the present L. C. Graves Co., the Danville plant and the United Automobile Body Co., Cleveland, the latter company having been purchased by the Graves company a short time ago. The large assembly floor at the Danville plant will be used exclusively for steam and electric railroad body equipment, such as is required for gasoline-driven railroad coaches, which are becoming extensively used for branches, extensions and short runs on both steam and electric lines. The Penn-

sylvania plant will supply the eastern demand and the Danville plant will take care of Ohio and states west.

H. & M. Body Corp., Racine, Wis., has closed a contract with the Hupp Motor Car Corp., Detroit, for 6,500 open and closed automobile bodies for delivery in 1922 in carlots of 34 bodies each, beginning Jan. 1. The plant is operating with a force of 600, but more men will be added at once and by the end of the year 1,000 will be employed. Instead of closing for inventory during the latter half of December, the H. & H. company reduced operations the last 10 days of November to facilitate handling of the Hupp order, on which production will start at once. The company also is building all bodies for the Mitchell Motors Co., Racine.

American Motor Body Co. has transferred its general sales office from Philadelphia to 12262 Kercheval avenue, Detroit. The Detroit plant of the company has been extensively improved, and places the company in a position to offer the best facilities for the building of automobile bodies.

Phineas Jones & Co., 305 Market street, Newark, manufacturer of automobile bodies, wagons, etc., are taking bids for a one-story plant, 50 x 300 ft., on Hillside avenue, Hillside, estimated to cost about $300,000, including machinery. William E. Lehman, 738 Broad street, is architect.

Wisconsin Wagon Co., 115 S. Carroll street, Madison, Wis., has let the general contract to A. D. & J. O. Frederickson Co., local, for a three-story factory, 50 x 132 ft., to replace the one destroyed by fire recently. It will cost about $50,000, including equipment.

Manhattan Vehicle Co., 518 E. 80th street, New York, will make extensions and improvements in its automobile and automobile body manufacturing building, 75 x 100 ft., at 529-33 E. 80th streeet, to cost about $20,000. Peter Damm is president.

Thomas Wright Co., 71 Colden street, Jersey City, N. J., manufacturer of wagons, parts, etc., is having revised plans prepared for a one-story addition, 100 x 100 ft., estimated to cost about $27,000. Robert Shannon, 1 Bernius Court, is architect.

Lyster Body Co., 330 N. 5th street, Philadelphia, manufacturer of automobile bodies, has acquired the four-story factory at 408-14 N. Randolph street, 58 x 85 ft., and the one-story building at 407-11 N. Randolph street, for a new plant.

Auto Top Co., 316 Park avenue, Waterloo, Ia., has awarded contract to John J. Judd, 711 Baltimore street, for a one-story and basement plant to manufacture automobile tops and similar products. L. P. Miller is manager.

Hoover Wagon Co., York, Pa., manufacturer of automobile bodies, has purchased the two-story factory at Webster avenue and the Boulevard, Long Island City, comprising about 18,000 sq. ft., for a branch plant.

Indianapolis (Ind.) Body Corp. has had a suit for a receivership filed against it in superior court by Peter M. King, who asks judgment for $10,000 alleging that a balance of $3,563 on five notes is due to him.

Springfield Coach Works, Springfield, Mass., plans an early enlargement of its factory. Orders for bodies for the Rolls-Royce, Lincoln, Mercer and Cadillac companies have kept the concern busy at production.

P. Forschler Wagon & Mfg. Co., New Orleans, will establish a temporary factory at 2831 Burgundy street pending the rebuilding of its plant recently destroyed by fire. J. A. Maschek is general manager.

Studebaker Corp., South Bend, Ind., is arranging to manufacture closed and other bodies for its cars and will remodel plant No. 1, heretofore devoted to wagon manufacture for this purpose.

American Body Co., 1200 Niagara street, Buffalo, manufacturer of automobile bodies, is perfecting plans for the immediate erection of its three-story addition, 50 x 50 ft.

The Fisher Body Corporation, Detroit, will erect a two-story machine shop, 30 x 60 ft., at a cost of approximately $30,000.

Automobile Show at a Glance

Opening date—Saturday, Jan. 7, at 2 p. m.

Open daily thereafter, except Sunday, from 10:30 a. m. to 10:30 p. m., until Saturday, Jan. 14, inclusive.

Auspices of National Automobile Chamber of Commerce.

Location, Grand Central Palace, Lexington avenue, 46th to 47th streets. Four lower floors.

How to get there—Lexington avenue subway to 42nd street or 7th avenue Subway to Times Square and shuttle to Grand Central station; or third avenue elevated to 47th street; or following surface lines: 42nd street, Madison avenue, Lexington avenue, Third avenue.

Number of exhibitors of passenger cars, 92.

Number of makes shown for first time, 12.

Number of exhibitors of accessories, 250.

Manager—S. A. Miles.

Show committee—H. M. Jewett, Paige Detroit Motor Car Co., chairman; J. Walter Drake, Hupp Motor Car Co.; F. C. Chandler, Chandler Motor Car Co.

Highest priced car, $11,000.

Lowest priced car, $525.

Cars Exhibited at New York Show

Main floor spaces—A-1, Cole; A-2, Chalmers; A-3, Reo; A-4, Paige; A-5, Packard; A-6, Jordan; A-7, Haynes; A-8, Lincoln; A-9, Maxwell; A-10, Dort; A-11, Dodge Brothers; A-12, Overland and Willys-Knight; A-13, Oldsmobile; A-14, Hudson; A-15, Studebaker; A-16, Chevrolet; A-17, Oakland; A-18, Lexington; A-19, Buick; A-20, Cadillac; A-21, Marmon; A-22, Peerless; A-23, Pierce-Arrow; A-24, Auburn; A-25, Velie; A-26, Franklin; A-27, Chandler; A-28, Apperson; A-29, Gardner; A-30, Nash; A-31, Hupmobile and A-32, Cleveland.

Second floor spaces—B-1, Columbia; B-2, Mercer; B-3, Roamer; B-4, Case; B-5, Milburn; B-6, Davis; B-7, Crow-Elkhart; B-8, La Fayette; B-9, Moon; B-10, H. C. S.; B-11, Saxon-Duplex; B-12, Grant; B-13, Holmes; B-14, Elcar; B-15, Premier; B-16, National; B-17, Kissel; B-18, Westcott; B-19, Maibohm; B-20, McFarlan; B-21, R & V Knight; B-22, Standard; B-23, Mitchell; B-24, Locomobile; B-25, Earl; B-26, Stearns; B-27, Stephens; B-28, Stutz; B-29, Liberty; B-30, Elgin, and B-31, Templar.

Third floor spaces—C-1, Durant; C-2, Kline Kar; C-3, King; C-4, Dorris; C-5, Stevens-Duryea; C-6, Detroit Electric; C-7, Pilot; C-8, Goodspeed; C-9, Handley-Knight; C-10, Ambassador; C-11, Essex; C-12, Rausch & Lang; C-13, Noma; C-14, Sayers; C-15, Hanson; C-16, Wills Sainte Claire; C-17, allotted to accessory companies; C-18, Paterson; C-19, Dixie Flyer; C-20, Anderson; C-21, duPont, and, C-22, Stanley.

Fourth floor spaces—D-1 to 3, Leach; D-4 to 6, Vauxhan; D-7 to 9, Rickenbacker; D-10 to 12, Rotary (Bournonville); D-13 to 15, Itala; D-176-179, Kelsey, and D-180-182, Hatfield.

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. XLIII. No. 10 JANUARY, 1922 $2.00 Per Year Issued Monthly

Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City.
Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3.

The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

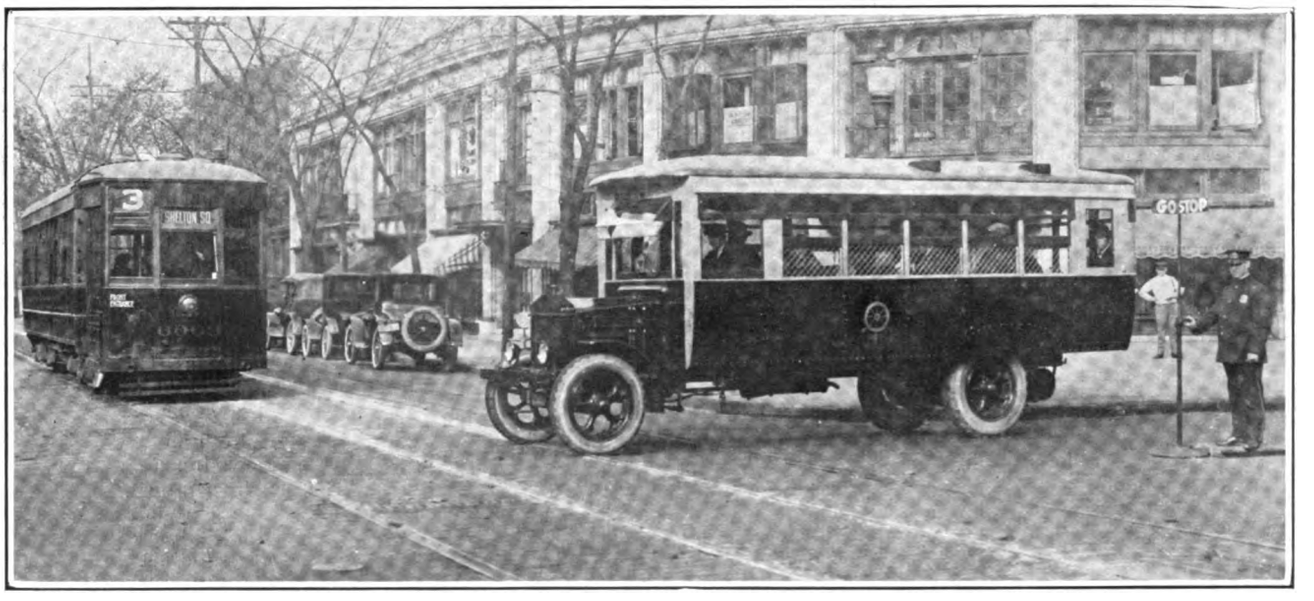
Vol. LXIII NEW YORK, JANUARY, 1922 No. 10

Motor Bus Prospects Very Bright for 1922

Extension of Use of Truck Chassis Very Interesting to Truck Manufacturers and Body Builders—Assistance and Ideas from Trolley Constructors

WITHIN a couple of years, practically all the traction lines of the country have ceased to be profitable. With the rise in wages, in repair costs, in the cost of all materials and supplies on the one hand, the electric traction interests were confronted by losses which could be avoided only by increased fares. But an increase besides being very unpopular, so that it was resisted by all the people, individually and as a body by means of adverse laws and city restrictions, also cut down traffic.

The revenue of the tractions then was forced by the war into this peculiar financial situation, profits could not be made at a low and popular rate of fare; a higher profitable rate cut down the number of passengers so that with lighter traffic no money was made anyhow; a low rate which brought many passengers was unprofitable so the larger the number of passengers the larger the loss. Furthermore, in such a situation which has not improved materially to date, there could be no expansion, no further reaching out for new territories, no additional trackage. This was because the investment in franchises, tracks, rolling stock, power plants, overhead work, and other necessities ran to such huge totals as to make these expansions even more unprofitable than existing lines.



New type motor bus developed and put into service in Buffalo by Pierce-Arrow Motor Car Co. Mounted on 2-ton dual-valve chassis with pneumatic tires. Seats 25 persons.

Busses As Traction Auxiliaries

In such a situation, traction managers have turned to what was formerly considered an outlaw and an enemy, the motor bus. This is being used as an auxiliary on parallel lines to take off peak traffic and thus permit

marked reductions in the rolling stock used and power consumed. It is being used as feeders on small or unprofitable lines, the bus replacing the trolley but connecting into the larger system, also on new lines or extensions of existing lines, for a bus line can be started without track work, overhead work, power plant additions, and many other costly items of the electric trolley. In rural school, and especially consolidated school districts, as recently pointed out in these columns, the bus has a peculiar and distinctive field, upon which trolleys can never encroach, because the nature of the territory is such that it would never support a trolley investment in traffic. The bus too, has a peculiar field all its own in the city lines through the finest of streets. It has been found that such lines are welcomed where trolleys would be bitterly opposed. In these and too many other ways to warrant enumeration here, the motor bus seems to be entering upon a period of great usefulness, and consequently if carefully handled, one of great prosperity to manufacturers of smaller-capacity truck chassis. In order to get anywhere with the bus as a method of transporting passengers economically and efficiently, the manufacturers of equipment must cooperate heartily and thoroughly with the electric traction men, who have spent their lives in handling passengers and know or should know all there is to this work.

To them, the motor bus is only a modified trolley, that is a new piece of equipment, and not the heart around which the whole new system of traction is created. This is well brought out by Walter Jackson, a consulting engineer in the electric railroad field, in his address recently before the motor truck section, National Automobile Chamber of Commerce. Starting with the statement that America is usually in the fore front of new movements but in the case of motor bus development must yield first place to Great Britain, which was active along motor bus lines as early as 1906, he continued, today we have in London a motor bus organization that will have carried close to a billion passengers for the year just ended (1921); and it carried them with the same reliability and safety that has hitherto been a distinction of the electric street car.

Outside of London, where the bus is but one of four means of transport, are scores of places where it is the only means of transport; where it has opened up stretches of almost-forgotten country, made the farmer familiar with the town, and the townsman familiar with the farm. In the great cities of Sheffield, Birmingham, Manchester, Liverpool, Edinburgh and many others, it has come to the rescue of tramway systems that could no longer afford to grow by means of the trackway. In these cities it has become the accepted method of making extensions, of handling crosstown routes, of short routing part of rush-hour loads that would otherwise congest on overcrowded highways, of taking people out on Sunday and holidays into trackless districts of little population but much beauty.

Then too, great interurban bus systems have been built up. Out of Birmingham, for example, radiate more than 200 routes through 16 counties, tying together city with seashore and woodland, or serving the more material purpose of giving more frequent service between communities whose industries lead to interchange of men and goods. Runs up to 150 miles a day are taken as a matter of course; and while they do not pretend to outspeed the railway, they draw a lot of people to whom a close-to-nature and closer-to-destination ride means more than the saving of some hours.

Outside of these all the year services are the chars-a-banc or motor coaches, less elegantly called "rubberneck wagons" in this country. They have made the vacation of the man of minor means begin at his door. His baggage travels ahead of him by motor van, while he rides in a reserved seat as much a king of the road as any millionaire. The dimensions which this class of traffic has reached with the last two post-war seasons are simply appalling to the steam railroader who is trying to meet that slogan of "First-Class Service at Third-Class Fares."

Many Private Cars in U. S. a Bus Handicap

Having sketched briefly what the worthy cousin overseas has done, let us go home and look over the situation. We will find that our later coming of good roads and our over-tracking of many parts of the country were logical reasons for our lagging in the motor bus field. So, too, the relatively larger use of the private automobile in the United States* has obscured the possibilities of rubber-tired common carriers.

Population has not always gone to the place where railroad facilities were most abundant. In recent years, also, the economics of railway operation have become bettter known and this knowledge has discouraged the reckless construction of the early years of this century. We find that situations have arisen in both city and country where there are people to be served with transport but not enough of them in any one place to justify a specialized roadway (the track) which costs just as much for one passenger as for 100. This is the situation in the large. What is it in detail?

We have in the United States and Canada between 900 and 1,000 electric railway operating companies. The number of cities which they serve is, of course, much greater than that. Most of these cities are growing. The youngest or growing parts of these communities necessarily have a much smaller population per acre than the older parts.

In many instances these newer sections are settled by the better-endowed element of the population. In other instances, the offshoot is due to the building of factories on cheap land outside the city limits. In any case, the extension of street railway track to these areas is financially impossible.

Flat Fare System a Great Drawback

Under the illogical flat fare system that is 100 percent American but not 100 percent sense, every extension of a street railway route has given the passenger more for his fare than he got before. Many electric railways would like to get rid of this burden if they could. It will be much easier for them to do so if they will run motor busses than if they keep the passenger on the srteet car. First of all, they will find the money for busses a lot easier than for track; secondly, they can give the suburban passengers the choice of maximum length trolley ride plus shuttle bus at a higher fare. And most Americans will pick the costlier but more enjoyable way.

No one can possibly forecast accurately the motor bus needs that will arise from this inevitable market. If it should run to 10 percent of the present electric car rolling stock, it would call for 10,000 motor busses, of say 25-seat capacity, within the next 5 years. This assumption is

* At the end of 1920 the United States had 105,683,108 people and 9,211,295 automobiles registered, or 1 car for each 11 people. Great Britain and Ireland had 46,080,000 people and 420,000 cars registered, or 1 to each 110 people. More recent figures would show a car for each 10 people in this country, and for each 105 people in Great Britain.

based upon the rate of growth in the number of cars during the pre-automobile era.

We have discussed the bus for extensions. Let us reverse the process now and discuss the bus for replacement of existing track when that track and its paving come around for renewal. If that track is of secondary importance, namely, not a railway trunk line, it will often be found more profitable or less unprofitable to substitute a motor bus service. Electric railways have a crushing burden to meet in the paving tax. A generation of agitation has led to almost no relief. What can't be cured may be escaped by recourse to the bus.

Relief for the Street Railway

Then there is the matter of relieving the street railway during rush hours. That proposition may provoke a smile among some electric railways when they contrast the high carrying power of the street car and train with that of the bus. But every situation must be judged on its own merits. Assume, for example, that the existing trackway is overburdened during the rush hours. The only way to relieve it, according to orthodox railroading would be to widen the street, build a subway or add another route on a nearby street—all fearfully costly methods because the work would have to be done in the district where land is most valuable and where disturbance of other interests would be greatest.

On the other hand, consider the bus. It can take advantage of any street in the area without disturbing anybody. It can take the shortest way; and taking the shortest way gives the carrier a right to ask for a special fare because the passenger has the choice of direct vs. roundabout service. When the motor bus is used as an auxiliary in this way, its profitableness or lack of profitableness is not to be measured by what it collects itself but by the effect it has on the transportation system as a whole. If by relieving congestion, it raises the car speed one mile per hour during the rush enabling the railways to get 10 percent or more work per hour out of its men and cars.

Busses Cost More But Earn More

It is just as well to admit at once that the motor bus costs more per seat to operate; but it is well to impress the railway man with the fact that its potential earning powers per seat are higher. Not only is this due to the various justifications for a higher rate of fare on the bus, but to the fact that the operator can use his equipment to so much greater advantage than he can use a vehicle tied to rails or wire. The bus has the basic advantage of going after the customer at the curb,—a wonderful advantage in the cultivation of short-haul traffic.

As it is not tied up to any route, the motor bus fleet can always be shifted to meet any special conditions. You can concentrate for the shopper and matinee patron; for the arrival of the circus; for the trips to the countryside; for parties of people who want to travel semi-privately to ball games, lectures, meetings or what-not. It is the shock batallion of the street railway.

So far we have discussed the motor bus in its relation to the street railway as a supplement. Now we must go deeper and discuss the possibility of the motor bus actually supplanting the street railway in any large fashion. Is this possible? If possible what conditions make it so?

Of course, the individual jitney bus cannot be seriously considered as the successor of the street railway. A community must depend upon a centralized, reliable organization for transport. It cannot be left to the mercies of untaxed, unregulated hackmen who come and go as they list, using disreputable equipment that would not be tolerated from a company and possessing no financial responsibility. The only reason that the jitney has not been permanently wiped out is its convenience as a club for battering the street railway.

Now without burdening you with figures of comparative cost, it is a fact that the traffic needs of communities between, say, 25,000 and 100,000 people can be met, for the greater part, far more cheaply with modern lightweight, one-man trolley cars plus rush-hour trains than with any known type of motor bus. The great "but" lies in the fact that the cost of running a street railway is not merely operating costs. These are, maybe, one-half of the operating costs of the bus. It is the accumulated overhead of a generation that is choking many street railways to death.

It is not meet for us to inquire whether that overhead was due to overbuilding or overcapitalization; whether it was due to failing to amortize the cost of growing with the art; whether it was due to paying unearned dividends instead of setting up a proper depreciation fund; whether it was due to long, costly strikes; whether it was due to the failure to earn increases in revenue proportionate to increase in operating costs during this war and post-war period; whether it was due to mismanagement by the operators or to persecution by the politicians; whether it was due to demanding a rate of return on war-price valuations big enough to renew the credit of the industry. Whatever the cause or causes, the stark, staring fact is that hundreds of electric railways say that they cannot exist on any but fares ranging from 7 to 10 cents for rides that often do not average more than 1.5 to 2 miles.

Largest Potential Field

Here, then, is by far the largest potential field of the motor bus. Coming into the ring with no hoary overhead and with very small fixed charges in any case, it may well be that a properly organized motor-bus company can meet, if not go below, the fares that are being charged in scores and scores of cities and towns today. It is purely a question as to whether those who control electric railways will prefer to cut their overhead obligations to the bone or permit themselves to be ousted altogether. At the moment, they are faced only by the undisciplined hordes of jitneurs. Tomorrow, they may be faced by men from their own ranks, alive to every weakness in their armor and keen to make use of a vehicle of unlimited mobility.

A few words will suffice in connection with the interurban situation. There are already thousands of busses in use on highways that penetrate districts that have had little or no railway service, whether steam or electric. As regards the steam railroads, it seems incredible that they can continue much longer to operate branch lines of light traffic once the paved highway has come into their district. As regards the electric interurban railway which is run on short headways and in economical single-car units there is less to expect for the motor bus except in those cases—particularly in the east—where the right-of-way speed advantage of the trolley is whittled away by the slow, annoying travel through the intervening and terminal cities. The fate of New England cross-country lines is prophetic in that respect, only it is a pity that the successors should be the jitney instead of the motor bus. There is a wide difference between the two, and it is the duty of this organization to make that difference clear.

Alcohol As a Motor Fuel in Cuba

The possibility of using the by-products of sugar making, especially the heavy molasses residue, for production of alcohol suitable for use in motor vehicles has only recently attracted general attention in Cuba.

Experiments with alcohol as a fuel for automobile and other gasoline engines have been carried on for some years with encouraging results by distillers and others, but until recently the product was not offered to the trade in active competition with gasoline.

The slowness with which alcohol has won acceptance as a fuel for gasoline engines in Cuba is partly explained by the rules for denaturizing which were in force up to July 2, 1921. In order to protect the revenue derived from alcohol utilizable as a beverage, the government required the addition to alcohol intended for fuel of certain denaturizing elements which, when the alcohol was burned, produced a deposit of naphthalene.

To eliminate this difficulty, a decree was issued prescribing a formula for denaturizing alcohol testing 95 rectified degrees (grados rectificados) intended for fuel purposes.

Manufacturers claim that for use in Cuba the addition of gasoline prescribed in the formula is unnecessary, since under the temperatures prevailing in the island, alcohol vaporizes satisfactorily without it. The trade, however, favored the addition of gasoline to make doubly sure that vaporizing would be satisfactory and that no dissatisfaction on this point could arise among those who tried out the new fuel. The coloring, another constituent, is intended to allow alcohol denaturized according to the formula to be easily distinguished from that otherwise modified for industrial uses.

A large number of distillers in various parts of the island are now manufacturing alcohol suitable for use in automobiles. During the month of August the production was between 13,000 and 14,000 gallons per day. Production is now equivalent to sale, and could be doubled.

As yet, only the lower grades of the molasses by-products are used in manufacturing motor spirit. About 2½ gallons of molasses are required for producing 1 gallon of the fuel. Manufacturers believe that with improvement in methods of production it may be profitable to manufacture alcohol from the pressed cane fiber (bagasse), which is now largely consumed directly in the furnaces of the sugar mills.

The representative of one of the largest producers of motor spirit states that with molasses at its present level his company can produce motor spirit to be sold at 20 cents per gallon.

Though the consumption of motor spirit has increased rapidly since July last, it can not be said that its value compared to gasoline as a fuel is yet a matter of common agreement in this market. The manufacturers claim that alcohol modified as required by the decree cited gives, when used in automobiles, mileage equal to that attained with gasoline.

Some users, among them some who are very anxious to see alcohol develop as a motor fuel, have not had such favorable results and insist that no definite statement can yet be made concerning the best method for adapting alcohol for use in automobiles nor as to its mileage cost compared to gasoline.

Certain Changes in Motor Required

It is generally accepted that much better operating results are obtained when alcohol is modified by the addition of certain other substances, especially ones which furnish a certain amount of lubrication and eliminate the tendency of rusting which appears when alcohol is used alone. The adjustment of the motor for the modified "motor spirit" has a large effect on efficiency obtained.

The changes which have been found necessary are simple and vary with the makes of machines. In some, the adjustment of the needle valve in the carbureter is necessary. In carbureters which do not have needle-valve adjustment it is necessary to bore a larger hole in the jet feeding the alcohol. Cork floats must be coated with wax to make them impermeable to alcohol or must be replaced by metal floats.

The deposit of carbon in the engine when motor spirit is used is reported much less than with gasoline fuel.

The current prices of motor spirit as sold on the street to the consumer is 27 to 30 cents. This compares with a current retail price of gasoline of about 45 cents.

Motorists' Book Review

Airplane Engine Cyclopedia. By Glenn D. Angle, 547 pp., 6 x 9, blue buckram cover, 503 illustrations. Airplane Engine Encyclopedia Co., Reibold Bldg., Dayton, O.

This splendid new work should fill a long felt want, in that it supplies information which is not available anywhere else. The name encyclopedia gives a faint idea of its contents, which comprise nearly 550 pages of illustrations, descriptions and data on airplane engines which have been, or are now being manufactured. Reference is made to 275 makes of engines, in a total of 858 models. Generally speaking the line drawings are excellent, although in a few instances the best selection was not made, as for instance, no sections are given of the well-known Curtiss OX 2 and V 2, although very many half tones are shown of both. The work is not restricted to any country but covers the airplane engines of the world, for all time. As the publishers say, it is both a history of the industry to date and a technical digest of available information of the subject of engines.

Automobile Expense Record. 84 pp., 8 x 10½, brown buckram cover. Motorists' Textbook Co., Fourth avenue, New York.

A blank book for keeping track of all expenses connected with the use of the car. In the front are some 72 pages for trips, with columns for all the ordinary expenses, while at the back are provided some 4 pages for monthly and yearly summaries and totals, and 6 pages for tire records. The whole makes a very neat compact method of keeping tabs on the car in a business like manner.

Cyprus As a Motor Market

Cyprus claims to be proud of its 650 miles of motor roads, and particular attention is paid to the maintenance of these. Throughout the island communications are good, and the prosperous natives are improving motor cars at the rate of a 100 a year. As this year's census shows a total population of 310,709 the ratio of imports per head must be regarded as good. There is also a lively demand for tractors, and the agricultural department has instituted a hire service for these machines. Many farmers declare that they are only waiting for the fall in prices to buy agricultural machines. The island's postal service is practically all done by motor transport.

Interesting Features in New Trolley Bus Design

Combined Efforts of Westinghouse and St. Louis Car Company Produce a Chassis and Body Combination of Superior Utility and Excellence

BUS business is booming all over the country. The motor bus as a separate unit in transportation, as pointed out in our leading article, is finding great favor, also as a feeder for established lines, and otherwise. So too, with the trolley bus which is a motor bus chassis, with electric power and operating on the existing overhead trolley wires. All these units have been found by a careful study of transportation problems, to have their individual uses and special benefits and economies. It is not now expected by traction experts that the bus will take the place of vehicles operated on rails, but rather that there is a distinct field outside of the traction lines which the bus can fill most advantageously.

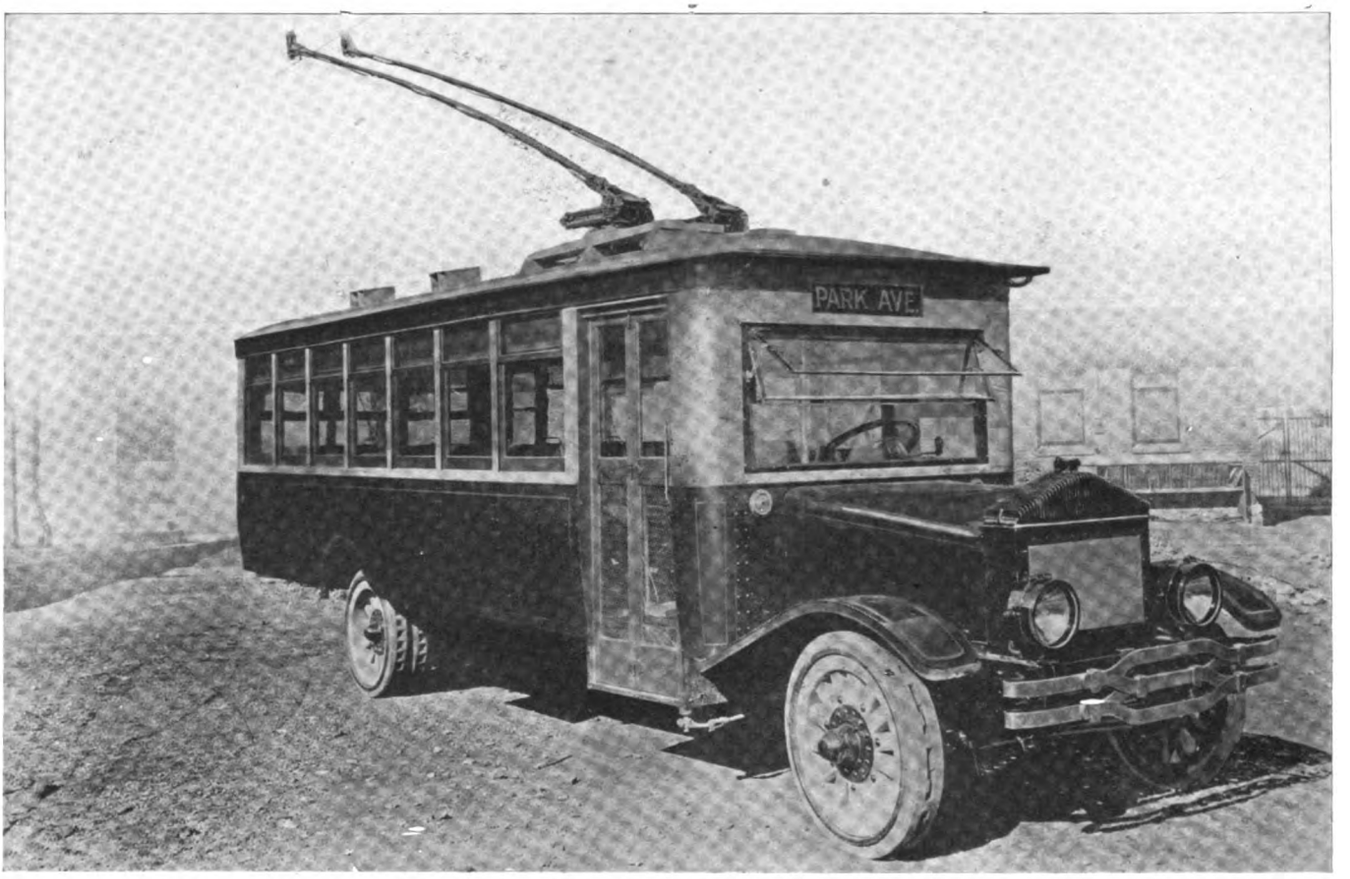


Fig. 1. Swivel Hays collectors permit wide latitude of movement.

A certain section of this outside field, where service is infrequent, can best be filled by the gasoline propelled bus. Another section, where service is more frequent, and is more closely allied to the traction lines, can be filled more advantageously by the electrically propelled vehicle, or trolley bus, as it is called.

The St. Louis Car Co. recognizing the above facts has recently completed a trolley bus which presents a number of attractive features. The bus was built for exhibition in connection with the proposed installation of trolley buses in Detroit. The electrical equipment was supplied by the Westinghouse Electric and Mfg. Co.

An important feature of the construction, is that the body is built directly on the chassis frame, thus avoiding the duplication of frame members, which occurs when a separate body frame is employed, and giving a very light and strong construction.

The wheel base is 194 in., and the overall length of the bus is 26 ft. Nine cross and two longitudinal seats are provided, giving a seating capacity of 29. The seats are deeply upholstered and provided with easy springs, which add greatly to the comfort of the passengers.

The driver is located at the front on the lefthand side, and the entrance and exit door is directly at his right. From the driver's position, a clear unobstructed view ahead is obtained, through a single window of the "clear vision" wind shield type, which extends across the entire front of the bus.

Foot operated band brakes are provided on all four wheels, and a separate pair of hand operated emergency band brakes are supplied on the rear wheels. The total wight of the bus is approximately 10,500 lb.

Two Westinghouse type 506-AN-2, 25 hp. ball bearing motors are used. The motors are mounted beneath the body and are connected in tandem with a soft shaft and "splicer" universal joints. The connection is made from the rear motor through a propeller shaft and universal joint to a "Wisconsin" worm drive axle having a gear ratio of 6.5 to 1.

The control apparatus is mounted underneath the hood. This location of the apparatus is ideal in many ways as it provides for easy inspection, places the apparatus in a position where it is well above the mire of the road, simplifies the wiring, and adds a very appreciable factor of safety, as it places the current handling apparatus in a steel compartment entirely outside of, and not under the bus body.

The control is of the series parallel type. Eight magnetically operated switches give the necessary combinations for four steps and three in parallel. The control is operated by means of a foot pedal which is pivoted at a point under the center of the foot, so that the foot rests comfortably at all times on the pedal and a slight rocking motion forward and backward controls the various steps.

There are three operating positions to the foot pedal which are indicated by "feel" to the operator by a star wheel provided on the foot operated controller. When the foot pedal is placed in the first position, the motors are connected in series and the total external resistance is thrown in circuit. When moved to the second position, the magnetic switches close automatically in proper sequence until all resistance is cut out and the motors are in "full series."

On the third position, the automatic step by step motion takes place up to the "full on" or "parallel" position. The pedal is returned to the "off" position by means of a spring. Both sides of the trolley circuit are opened in the "off" position, thus reducing the chance of leakage to the bus body to a minimum.

The automatic progressive action of the control is so arranged that it is slowed down as the load on the main motors is increased, but under no conditions is it entirely stopped, so the difficulty of "stalling" which may occur in other automatic types under heavy load, is obviated.

Reversing is accomplished by means of a simple knife switch type of reverser which is mounted on the front of the dash, under the hood with its handle projecting through the dash in a convenient position near the operator.

An overload trip opens all of the magnetic switches in case of excessive loads. The overload trip is mounted on the dash, under the hood and can be tripped or reset by the operator by means of buttons located on the dash, within his reach.

Two separate overhead collectors are provided which are similar in construction to the standard trolley used on light traction cars, except that they are provided with ball bearing swivel harps.

The collectors will permit a deviation of 10 ft. on either side of the overhead wires. The bus is equipped with electric heaters, electric lights and electric signals.

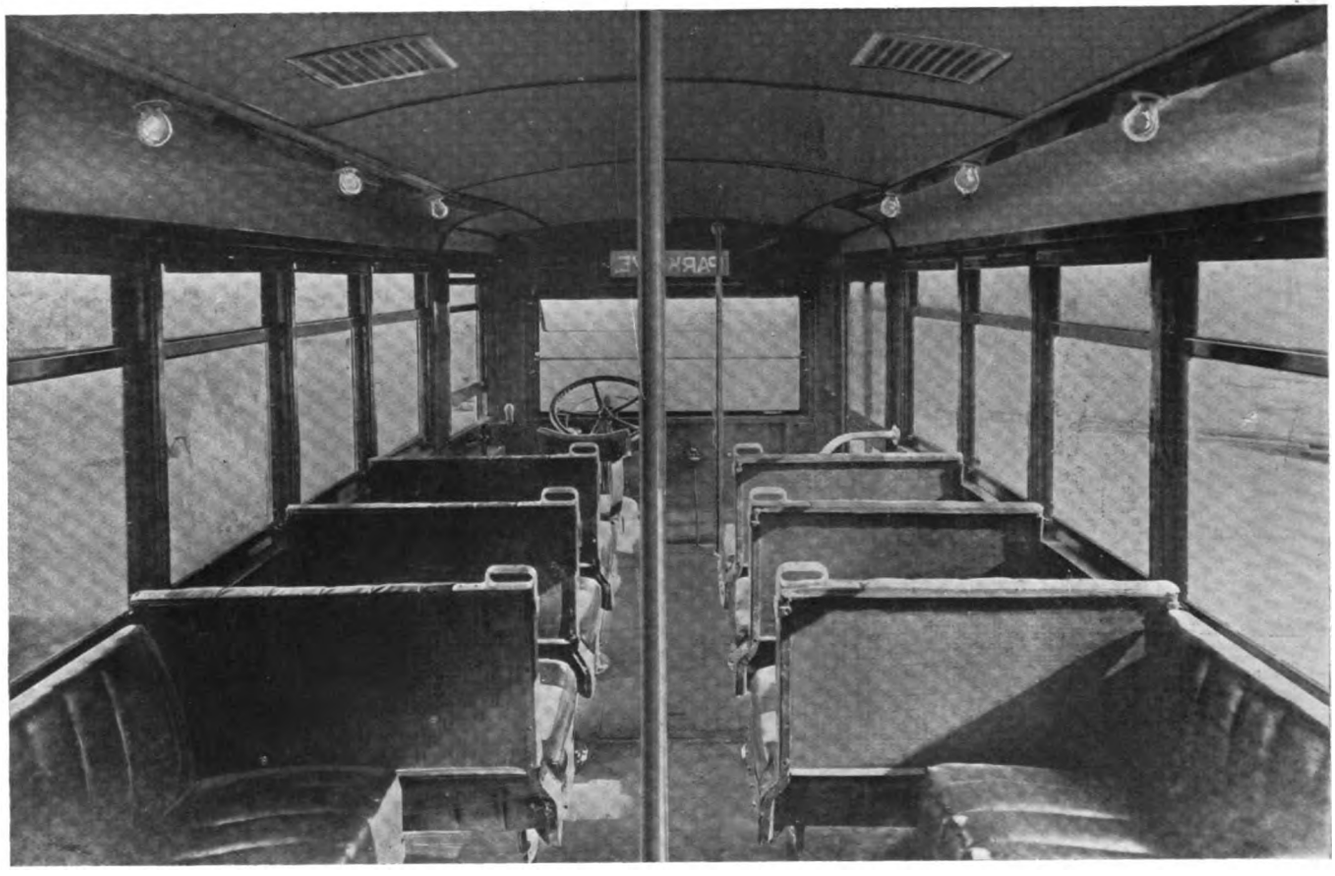


Fig. 2. Interior of St. Louis Car Co. bus showing driver's position.

This bus makes a valuable addition to the growing fleet of trolley busses, from which the electric traction companies can select a suitable type to supplement their "rail service" in localities where complete street car service is not at present warranted.

That high import duty and fuel costs hamper the sales of American cars in France is evidenced by the fact that only three American cars were sold at this year's salon, the reasons assigned being their initial cost in France is rather high and they are too powerful for the requirements of the French public.

Your credit customers may not be in a hurry, but your cash trade will appreciate being served quickly.

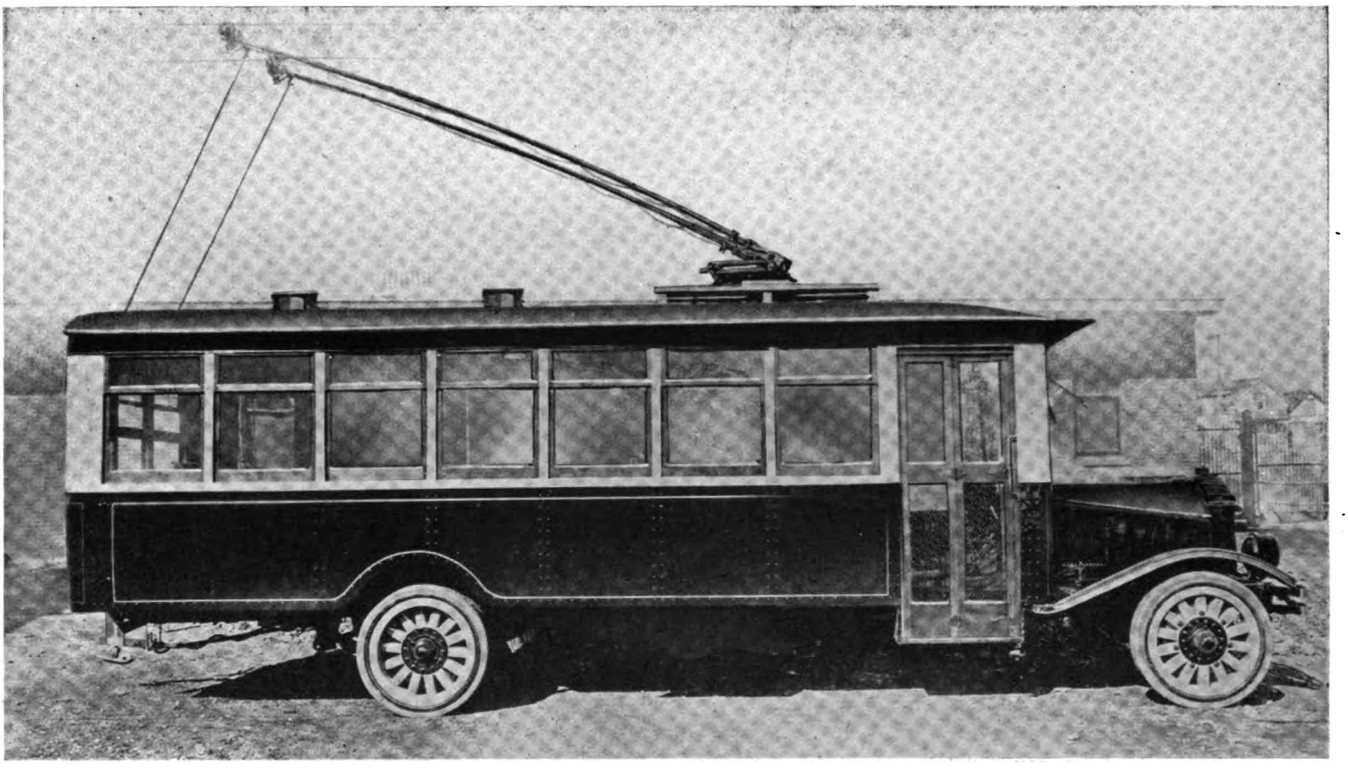


Fig. 3. New bus equipped with two Westinghouse 25 h.p. motors.

Says Ford Plans "Cottonoid" Autos

Roger Babson, back from a visit with Henry Ford at the latter's laboratories, asserts that he saw Ford at work on a process for the making of automobile bodies out of a composition consisting mainly of cotton. Babson says he saw a mound of a sticky, putty-like substance in the Detroit experimental establishment.

"What is that stuff," he says he asked Ford.

"That is a mixture of formaldehyde, glue and cotton," was the reply.

"And what are you intending to do with it?"

"Automobiles," was the answer.

"It is Ford's purpose to make a lighter and a cheaper automobile," Mr. Babson asserted. "So he goes to cotton. He works out a mixture for cottonoid. A durable, tough, long wearing material. If he is successful, he will in time block out automobiles much after the manner that a cook stamps out doughnuts. He believes his ideas will result in a greater revolution of the automobile industry than has the flivver.

The statistician says Mr. Ford disclosed to him the belief that the day of heavy automobiles is about over. His complaint is that an engine is forced to carry at all times a great superfluous load, a constant waste.

"I was in Detroit at Thanksgiving time," said Mr. Babson. "Before dinner was served, Ford said to his wife:

"'Remember 17 years ago, when you and I tramped the streets to get a chicken for our Thanksgiving dinner and not a store would trust us?'

"And after a moment he continued, 'and I paid the United States government $76,000,000 in taxes last year.'"

Ford wouldn't be surprised, he is quoted as saying, if people lived in cottonoid houses, rode in cottonoid trains and worked in cottonoid shops 17 years from now.

"Every one thinks Ford wants Muscle Shoals to produce fertilizer," says Babson. "It is my opinion that he wants it to turn out constituents for the making of aluminum for certain parts of automobiles."

Frame Standardization Under Way

Representatives of passenger-car frame manufacturers recently got together and determined to undertake the standardization of passenger car frames as it is felt that such standardization would be of material assistance to passenger car designers and to frame manufacturers. Information in reference to present frame practice is to be obtained as a basis for the standardization involved, a questionnaire requesting this information having been sent out of all passenger car manufacturers.

The standardization of frames will be of special assistance to many frame manufacturers because passenger car manufacturers are often willing to use a frame for which the frame manufacturer has the necessary tool equipment in case the design conforms fairly close to requirements. The adoption of definite frame standards will result in an increase in the number of such orders to the mutual advantage of both frame and passenger car manufacturers.

The next meeting of the frame manufacturers' division of the S. A. E. Standards committee will be held as soon as the information obtained as a result of sending out the questionnaire has been tabulated.

The division has definitely recommended a standard for passenger-car running-board brackets which will be acted upon at the Jan. 10 meeting of the S. A. E. standards committee. The standard specified but three sizes of brackets, but they are designed so that these three sizes will furnish a suitable range for all requirements by slightly shifting the position of the rivet holes in the frame. The width of the brackets can be changed readily to suit various widths of running-board.

Modern Upholstering for Fine Motor Cars--IV

Description of the Methods Used in Trimming the Three-Quarter Dome-Roof Landaulet, Materials Required, Special Layout and Marking, Other Points

NO ONE who has followed the trend of modern motor car construction will deny the increasing importance of high grade upholstery and its influence in selling cars more quickly, and through a general realization of this of the gradual increase in quality of the upholstery in lower, and still lower priced cars. Today, the well-upholstered car is the rule, rather than the exception.

This is undisputed for enclosed cars of all kinds. It is almost axiomatic that the enclosed car must be not alone well upholstered, but very well. All this has attracted increased attention to the general subject of trimming and the materials used. Following previous articles, in which the runabout or roadster, the touring car or phaeton, the single landaulet, and the small limousine or large coupe, have been described in detail, the present article will take up the round-corner dome-roof three-quarter landaulet. In this, for which we are indebted to Cooper's Vehicle Journal, London, the whole body is considered to be trimmed in leather, with nap cloth for the head lining.

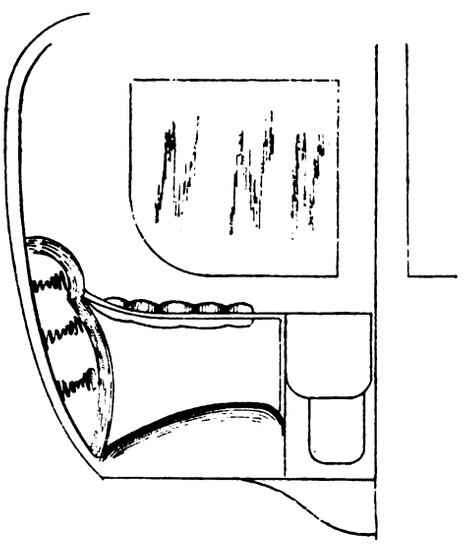


Fig. 14. Sketch of interior showing location of elbows (or arms rests), and their swept form.

To list all the materials necessary, at the beginning, will perhaps be helpful. This job requires 5 hides of leather if the driver's seat is of the same color and material as the interior, otherwise 1½ hides for the front seat, 3½ hides for the interior, 1 hide of enamel leather, 4½ yards cloth, 36 yards seaming lace, 45 yards pasting lace, if glass strings are fitted 7 yards broad lace, 6 yards sail canvas, 2 yards hessian canvas, 3 yards buckram canvas, 21 8-in. No. 12 springs, 44 5-in. No. 12 springs, 6 rouch ends or tassels for glass strings, 2 bracelets for handholders, 36 lb. horsehair, 1½ gross buttons, 2 spring cases, 12 yards wadding, 18 yards common webbing, 6 yards best webbing, 3 yards carpet, 1 pair companions, 2 horse door pulls, glass string knobs and guards as required, 1 pair hand-holder fittings, 1 ball of seaming cord, 1 ball of twine, 1 reel of silk thread, 1 reel No. 25 thread, 3 curtain barrels, 3 trigger pulls, 3 tassels, 2¾ yards of lute string, 9 yards of curtain cord, 6 horn-headed nails, and if curtains are fitted to the sidelights, 5 barrels, 5 trigger pulls, 5 tassels, 4½ yards lute string, 12 yards curtain cord, and 10 horn nails are required, 6 yards of linen or other material for covering seats and cushion bottoms, ¾ yard of American cloth, 1 paper net, 3 yards of hat cord, 4 horn eyes with screws, and 1 horn hook with screw, which completes the list, and from which the prime cost of the materials for the job can be readily calculated.

Description of Trimming Required

The interior of the body is trimmed with thin squabs to the quarters, and a squab of good depth, stuffed nice and full to the back seat, two padded elbows are also fitted, made up on blocks of wood, each fixed with two angle plates beneath; there should be a small pocket on the doors. The folding seats are fixed on the inside front to fold into a recess at the bottom, being covered with leather flaps to completely conceal them when folded down. A squab is fixed on the upper part of the inside front, and the cushion is made up in squares.

The driver's seat is trimmed in the usual manner, with small quarters and well stuffed back squabs; the driver's cushion is plain, and a pocket is fitted on the near side door with flap, the offside being recessed and covered plain to clear and leave ample room for handling the levers. This description should make it clear as far as details are concerned to make a proper and complete job.

Setting Out the Work

In commencing the work first set out the body for the lace lines and mark the position of the elbows. These should not be too high from the top of the cushion, and should be made up in a slightly swept form, as shown in the sketch, Fig. 14. As a general rule, the top of the elbow should not be more than 9 in. from the top of the cushion, measured at the bottom of the swept elbow line.

The lace line should be carried along the elbow across the quarter pocket and also the door pocket in order to keep the waist rail uniform, and by determining the width of the quarter pocket, the correct size of the quarter squabs can be obtained. This squab is trimmed with straight flutes, the pleats being stitched to the canvas.

The back squab should be 30 in. deep from the seat board to the top rail, and if the body does not reach this depth, a piece of wood should be fixed inside the top rail to make up this depth, providing it does not interfere with the head closing down level. The back squab is trimmed in half diamonds and pipes, and the folding seats in squares. At the top of the inside front is a squab made up in half diamonds; the ends of this squab are carried down to the carpet line in the form of a flute, the squab covering the whole space between the folding seats and the top of the waist rail.

The door pockets should be about 18 in. wide, and the space between the bottom of the pocket and the carpet line should be uniform with the space at the sides, while the door pockets are made up with a single gusset. The foregoing details should be well borne in mind.

First fit up the quarter and back canvases for the hind seat, and also the canvas for the inside front, then take out and lay on the bench and mark out the quarters for straight flutes, 3½ in. wide; next take the pack canvas,

allow 3 in. more in the depth to allow for the springs, also 1½ in. in the width for contraction, mark out for half diamonds and pipes, 4¼ in. wide, the top row of buttons should be 7 in. from the top, the bottom of the half diamonds 5 in. from the top buttons, and the bottom row of buttons 6 in. from the bottom line. Mark out the inside front for half diamonds 4 in. or 4¼ in. wide and about 5 in. deep, also fit the canvas for the cushion and mark out same for 5½ in. squares.

Marking Out Material

In marking out the material, fullness should be allowed in the quarters, 1 in. across and a little extra along the top and bottom in depth for tacking. For the back squab allow 1½ in. across the pipes, 4 in. at the top, nothing between the top row of buttons and bottom of half diamonds, allow 1½ in. between bottom buttons and bottom of half diamonds, and 1 in. at the bottom, and at the ends allow sufficient to give room for stuffing up nice and full so that the swell will be level. For the inside front allow 1 in. across, ½ in. in the half diamonds, 1½ in. at the top and 1 in. at the bottom; it should further be noted that in making out the material for the cushion 1½ in. each way should be allowed in the squares.

The cushion is made in the all-over style; it will be necessary, therefore, to allow sufficient material to go right over to the bottom, bearing in mind that the front edge must be kept up firm and square. The tip seats are marked out in about 4-in. squares, but this will be determined by the size of the seats; allow 1 in. fullness each way and sufficient to carry over to the bottom of the seats; the bottoms should be covered with carpet and finished round level with the edge with seaming and pasting lace. The door pockets should be made up with a piece of material a little larger than the size of the space between the seaming lace at the waist rail and the lace at the carpet line on the one hand, and the width of the door.

For the quarter pockets, also, cut out a piece a little larger than the space occupied by the pocket, and there should be a flap with a margin below the pocket. Cut out pieces for the pockets and flaps, the pocket pieces being large enough to cover both back and front, so that there will not be a raw edge requiring to be bound; cut out pieces of buckram of the exact size required, on which fix an ornament about ¾ in. wide, cut out of linoleum or enamel leather, then paste up the pockets and flaps entirely and leave to dry; when dry, the flaps are bound round with a close edge welt of the same material as the job, and the pockets are made up with a single gusset and welted in the same way.

Next in order the driver's seat can be taken; therefore, fit and mark out the canvas in the following manner: The quarters should be marked out in half diamonds, 3¾ in. wide and 4½ in. deep, only two rows are necessary on most modern bodies; in the material allow 1 in. across and ½ in. between the top and bottom buttons, 1½ in. at the top and 1 in. at the bottom; if the body is to be trimmed with a roll-over quarter, allow 6 in. or more at the top, according to the thickness of the roll.

Proceed then to fit the back canvas, and allow 1½ in. extra in the depth for the springs, and 1½ in. in the length for contraction; mark out the half diamonds and flutes 4 in. wide, and in the material allow 1¼ in. across, 3 in. at the top, ½ in. in the half diamonds, ½ in. in the swell, and 1 in. at the bottom; also make up a pocket and flap for the near side door in the style explained in previous articles.

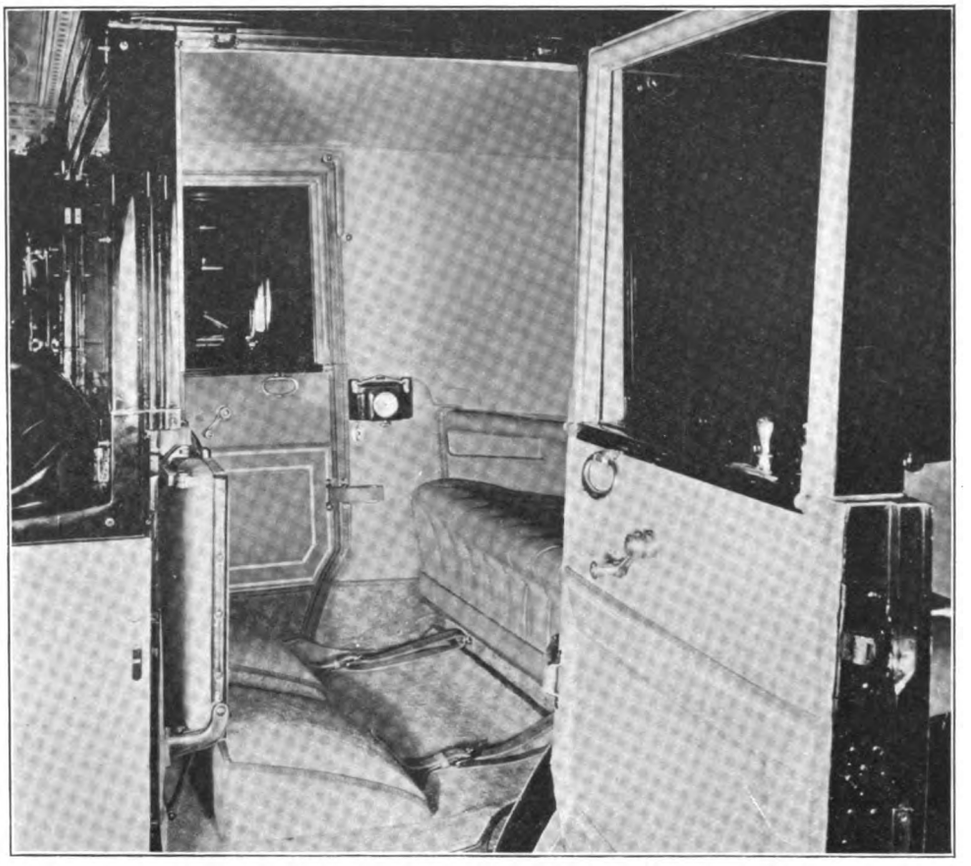


Fig. 15. Interior of Rolls-Royce Salamanca Cabriolet, showing broadcloth upholstering. Seats and backs are done with straight pipes, quarters, doors, top, other parts with smooth finish, no pleats. The tan broadcloth is a Boyriven product.

The next process is to set up the head; no definite directions can be given regarding this, as the setting up will depend entirely upon the design of the body and having regard also to the position of the back hoop stick. When this has been set in its proper position, the head lining can be gotten out and fitted. Here again, the head fitting will determine the manner in which the head lining can be fixed. A very common method is to carry the seaming lace along the bottom edge of the cant rail, right across the quarters and around the back, along the back hoop stick, and joining in the center.

The back and quarter cloth can be joined either up the center of the back, or back and quarters can be separate with a seam in each corner, and with seaming lace in the seam. The front part of the interior roof is backtacked

(Continued on Page 28)

Dull and More Permanent Finishes Interest Industry

Periodic Agitation for Dull Surface and Finish That Will Stick Better Is on Again—Why Dull Surfaces Cost More—Cheaper Production Methods Opposed

ONE of the most prominent manufacturers of fine finishing materials for automobile bodies, varnishes, etc., has stated that the dull surface coat and the best method of producing it crops up regularly every few years. Be that as it may, there is much agitation for it right now, and many firms are seeking a dull finish which is as permanent as the shiny one, yet which is cheaper to produce. As the varnish men see it, these conditions are contradictory, in that the only good way to produce a dull finish is to do extra work on the shiny outer coat, and consequently this finish, when done right must cost more, and be a slower job.

An engineer is quoted in a prominent trade paper as telling how he wanted a dull finish and could not get it at what he considered a fair price so he bought half a gallon of each of two kinds of paint, at a cost of $3, a brush, and by putting in his time for 9 hours produced his own "dull" finish. Now the fact is that he got just what he paid for, no more and no less, and his present fine job will look like nothing at all in a few months of use, for a hastily put on amateur job of this kind can not possibly be of a permanent or even of an excellent, lasting character. Very shortly he will begin to see the cracks and checks due to insufficient filler coats, lack of proper mixing of the pigments, and other causes. A man in the industry should know that there is no such profit in painting and varnishing as the difference between his $3.50 plus 9 hours time, and $150 to $215 quotations he got on job.

A great many people however, have no knowledge of finishing processes than to think this, which is perhaps why the subject, as well as that of a more permanent finish crops up so regularly. On the other hand, manufacturers do not feel that the present shiny, piano finish is the ideal but only the best available now. As one manufacturer put it, it is illogical almost to the point of absurdity to put a piano finish on an automobile body and then send it out to withstand experiences that would wreck a road roller. Marks of age and abuse come quickly, but sometimes they come sooner than they are expected. Possibly this accounts for the recurrent interest.

Dull Finish Withstands Wear Better

An alternative, which has found great favor in some quarters, is to turn out the final finish with a dull surface. This, in a measure of speaking, anticipates what is bound to happen sooner or later. An unfriendly and hypercritical way of looking at it would bring forth the suggestion that a finish of this kind has the effect of making a new car look a respectable age. But if a car having a dull finish looks the same after six months, a year, two years and possibly three, as it did in the first place, is there not something to be said for it?

Advocates of the dull finish—and there are many of them—also have another strong argument in its favor. It is that the highly polished surface, by its reflection of light, magnifies every irregularity in the surface; the dull surface, on the other hand, gives always an impression of uniformity. It is a matter of common experience, dating back to the days when the "best" buggy was repainted periodically, that a refinishing job often looks better "in the rough," than it does after the final coat of varnish has been flowed on.

From the standpoint of practicability, it may also be pointed out that a car having a dull finish not only fails to reveal its deterioration as rapidly as does one finished in the most approved style of the carriage trade, but also that superficial damage can be more easily repaired, while refinishing is very materially simplified. In other words, a scratch or scar in a dull-finished surface can be "touched up" with a fair degree of success, and provided the color is properly matched, will henceforth be inconspicuous, if not exactly invisible. A scratch or scar on a highly polished surface, however, is almost impossible of concealment. The surest way, invariably, is to do over the whole panel. If properly done, that requires skilled work, costly materials, and the expenditures of much time. In the case of a dull finish, it is often a case of renewing the outer coating only, but of course, after proper treatment of base.

There is another side to the question that is perhaps somewhat more important, however. That is the matter of appeal. Automobiles, done in black, and shining like a well-polished boot sell amazingly well, despite the fact that their finish is admittedly short-lived, costly to maintain and costly to renew.

But testimony is not wanting that the automobile owner does care how his car looks, despite his seeming heedlessness in that regard, and furthermore that, when offered any sort of option, he is both willing and able to give full play to his tastes as to color, contrast and surface appearance. A further point in favor of the dull finish is thus scored when it is remembered that many of the finest cars have been finished in that way, that body makers experience a certain more or less constant demand for such finishes, and finally, that frequent inquiries come from owners and dealers as to how dull finishes can best be produced.

Find Flat Finish Valuable

The Jordan Motor Car Co., whose cars are turned out in a special finish of this class, indicates that it is under considerable pressure to reveal its methods. Brewster & Co., one of the oldest and most respected survivors of the high-class coach and carriage trade in New York, say:

"We believe that we were the pioneer in establishing this form of finish and have used it uninterruptedly and successfully for the past 15 years. It is known as the 'Brewster oil finish' and is ground and prepared in our own works exclusively for our own use, and up to the present time has not been marketed. Through our experience we know that a car finished in this way will outlast at least two or three varnish finishes."

The Ditzler Color Co., which manufactures automobile painting materials exclusively, raises a practical point on the production side when it says:

"Some manufacturers who have come to us for 'oil finishes,' as we call them, explain that they are interested in such a finish because of simpleness of methods of application, whereby they effect a big saving in labor. The oil finishes, as we offer them, are applied in certain shades, three coats, all the same, 48 hours between coats and no

rubbing of coats or surfacing, as when varnish is applied. This material dries to an egg-shell or imitation rubbed finish and is very durable. In other shades we offer a first and second coat ground work and over the second coat ground the final coat or oil finish is applied."

Before touching on the other side of the question, a word on behalf of the big producer is necessary. Here is testimony from one who is in the difficult position of having to turn out a satisfactory finish by automatic methods. Says the assistant chief engineer: "It is our experience that a flat finish enamel cannot be run through the ovens at the high baking temperature which is necessary for a lasting finish. This is probably due to the fact that China wood oils are used in making up the enamel. We do not believe that this is an impossible proposition, but are of the opinion that if the demand were great enough, the enamel could be very readily worked out.

"Flat" surfaces are recognized by carriage painters as foundations, since an absolutely uniform base is necessary in building up a polish possessing the rich effect of depth, as well as a mere superficial gloss. "Flat" finishes in the general paint and varnish field, of course, are devised for the purpose of presenting a uniform tone—to walls, for example—without objectionable light reflection.

"French finish," "satin finish," and other suggestive names, however, imply a different origin. Apparently they come from the effort to tone down the mirror-like gloss from richly finished products, in order to impart an atmosphere of "elegance with ostentation." Fine furniture is often toned down in this way.

Dull finishes for automobiles were originated in this very way. In fact, the most expensive automobile finish to be considered, is that which has been worked up by the traditional methods of the old-time coachbuilders, and then toned down by rubbing with rotten stone and oil. All things considered, therefore, it is not surprising to find the average paint and varnish man pronouncing the dull finish more costly to produce and less durable.

Authorities Hold Otherwise, Too

A number of the older and best-known paint and varnish makers have contributed to the material from which this article is produced, among them, such concerns as Valentine & Co., the Murphy Varnish Co., The Sherwin-Williams Co., and the Hildreth Varnish Co., Inc. Opinions from these concerns are practically all to the same effect, that the dull finish is a luxury finish, because it must either be worked down from a lustrous surface, or else built up with flat-drying pigments, which the trade regards as non-durable. Perhaps the arugment against the dull finish, as it is generally understood, is best summarized in the words of J. H. Schumann, president of the Hilo Varnish Corp., who says dull finish on automobiles may be produced in one of two ways. First, the car may be finished in the usual manner and with the usual number of coats, applying the usual flowing coat of finishing varnish. After this has dried sufficiently hard it may be rubbed dull by the use of an abrasive, such as pumice stone or rotten stone, with either oil or water. This is the manner in which the highest type of dull finish is produced.

The second method is to replace the flowing coat of finishing varnish with a varnish preparation which will dry with a dull effect, instead of a glossy one. There is no known method by which this can be accomplished which improves the durability or wearing properties of the finishing varnish. In fact, most of the methods employed do not add to the durabilty of this coating, but rather detract from it. This second method is the one employed on cheaper jobs.

When a flowing varnish is allowed to dry the top surface is harder, tougher and more durable than the material underneath. One of the agencies causing the failure of the finishing surface is the abrasion of the finish. By rubbing the finishing coat to a flat effect this hard outer protecting layer is removed, presenting a less durable surface which, experience has shown, is not as durable as the original glossy one.

Glossy finishes, because they are smooth and hard and bright, do not retain dust and dirt particles on their surface as readily as flat or dull finishes. This dust and dirt sticking to the surface aids in the more rapid breaking down of the finish, by retaining moisture and allowing the softening action of the rain a longer time to work. Almost everyone has observed how a mud spot which is allowed to remain on the finish of a new car for any length of time leaves a mark behind which can only be removed with great difficulty. Where the finish is subject to alkali dust it would be possible to use a finishing varnish which would be most resistant to the action of this dust, but there would be no case in which a final finish would have this desirable effect, simply because it was flat.

Find Points of Agreement

That is no less conclusive than some of the foregoing testimony on the other side. It indicates pretty clearly that there is a marked difference of opinion in the trade as to the possibilities of developing a natural flat finish that will be durable and also will not show the effects of use as much as a glossed surface shows them. There is no difference of opinion as to the inferior durability of a natural gloss which has been rubbed flat, besides which it is out of the question in production work, because it is bound to be expensive.

The chapter will not be closed however, until something further is said. The whole history of lacquers and varnishes—and it is a long one—shows the continued effort to produce a highly permanent and resistent surface through the drying out of a surface coating, with or without pigment, which distributes itself uniformly by flowing, while its volatile constituents evaporate. The smoother the ground work and the more fluid the surface material at the time of application, the more uniform and lustrous the final effect. Hence, the effort of the varnish and enamel maker has been to secure the most durable, but yet elastic gums—for expansion and contraction of the base must be considered—which will work to best advantage in solution, dry out most uniformly, and finally offer the utmost resistance to abrasive action and the elements. Since the most lustrous surface is traditionally the highest development of the painter's or enameller's art, the whole trend in commercial painting has been toward applying a superficial glaze to groundwork.

If the high gloss can be sacrificed without sacrifice of tasteful effects however, there is room for development in several ways. One of them, already suggested, is the evolution of flat-drying surfaces by the development of both "binders" and "fillers," with that special end in view. It is not clear that much effort has been put forth in that direction.

The immediate need seems to be for finishes that will last longer, cost less and look better the second and third years. For such, the need is very great indeed.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO.

Heptagon Building, 153 Waverly Place, New York City

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXIII JANUARY, 1922 No. 10

American Airplane Achievements in 1921

IT will surprise many to learn of the great progress which was made by American airplanes in the year just ended. Undeniably, the manufacturers in this field have been and still are in very bad shape, due to lack of orders and no possibility of reasonable good sales, but the great fuss which has been made over this condition has obscured the progress which has been made elsewhere, and all of which points toward ultimate progress for the manufacturers.

Approximately 1,200 civil aircraft were operated in the United States, flying more than 6,500,000 miles and carrying approximately 275,000 passengers. This averages almost 18,000 miles flown per day right through the year, and more than 750 passengers taken up each and every day. All of which is no mean achievement for a supposed off year.

The air mail service reached a new plane of efficiency and delivered casual coast mail in New York within two days, as well as making actual continuous flight between San Francisco and New York in 24 hours. American flyers in American-built planes made a new world's altitude record of 37,800 ft., a new endurance record of more than 26 hours, a new closed course speed record of 176.3 m.p.h., the transcontinental flight from Jacksonville, Fla., to San Diego, Cal., was made in 22 hours 27 minutes, 12 navy seaplanes flew from San Diego to Panama, 3,200 miles, the bombing successes of the summer on the former German warships, parachute drops of 25,000 ft., the development and successful use of the 4,300 lb. aerial bomb, the new 700 h.p. engine was produced for test, the Larsen all-metal armored monoplane carrying 30 machine guns, the successful use of the geared propeller with three engines, all these were notable feats which did much to advance the airplane industry.

Along the line of actual commercial service, 15 flying boats of a well-known service flew 100,000 miles and carried 6,814 passengers and 29,002 lb. of freight between Key West and Havana, and 41 army airplanes operated on the aerial forest patrol in the national forests of the Pacific slope made 396 patrols, discovered 832 fires and provided daily protection for 7,230,450 sq. mi. of valuable timber land.

Government Fuel Report Not Encouraging

DETAILS of the recent government report on the available fuels in this country, recently given out, do not make pleasing reading for automotive manufacturers for they show that all available petroleum in this country and Mexico will be completely exhausted within 20 years. Since it will not be possible to get out 100 percent of the total in the ground, the actual point of exhaustion will be reached long before that time, and the point at which the pinch of dwindling supplies will begin to be oppressive will probably be reached before half that time.

In the light of that report it is rather unusual to note that the show this year, for the first time in several years, failed to provide anything essentially new in the way of vaporizers, or for that matter, failed to indicate in any way that manufacturers were, and users should be, concerned at all with the fuel situation. One maker in the entire list showed a new vaporizing outfit, but this was brought forth some six months ago. Moreover, it is rather a detail of using every drop of fuel than an entirely new and different device.

Similarly, the Society of Automotive Engineers at their annual convention, held during show week, failed to stress fuels and vaporizers to the extent that has been customary for some years. True there was Prof. Berry's excellent paper, but good as this was, the discussion of it brought forth practically no new ideas.

Why this should be so is difficult to say, and in combination with the very unfavorable government report, of which both the manufacturers and the engineers should have had advance information, it seems a singular omission.

Automobile Production in 1921

Estimating the average weight of iron and steel per passenger automobile at 1,500 lb. and the average weight per truck at 2,250 lb., the total amount of iron and steel used in automobile construction during the year was apparently about 1,175,000 gross tons. This is approximately 9 percent of the year's output of rolled and forged steel. The figure is based on a total production amounting to 1,680,000 cars and trucks, of which 145,000 or 8.63 percent were trucks, and the remainder passenger and other light cars, according to the National Automobile Chamber of Commerce. The total figure is a reduction of 24 percent from the 1920 output.

It is stated that the wholesale value of the cars and trucks produced in 1921 was $1,222,350,000, a reduction of 45 percent from 1920. The value of automobiles was stated at $1,088,100,000, or $702 per car, a reduction of 21¾ percent from the $897 average of 1920. The wholesale value of motor trucks produced is given as $134,250,000, an average of $968 per truck, or a reduction of 24 percent from the $1,273 average of 1920. Tire casings amounting to 19,379,000 were produced, together with inner tubes to the extent of 24,157,000 and solid tires numbering 377,000.

The figures given show an approximate total of 10,000,000 automobiles registered in the United States, of which 9,000,000 are cars and 1,000,000 are trucks.

Palace Show Great Success---Tremendous Attendance

Big National Show Marking Beginning of New Year and Indicates Greater Business, More Enthusiasm, Wider Public Interest—Many Price Reductions

MANY dire predictions have been made relative to the present and past conditions in the automotive industry, but if these critics had been present at Grand Central Palace, New York, during the week of Jan. 7 to 14 inclusive, they certainly would have been confounded. Not alone was all the old enthusiasm present, but in volume it was greater than ever before. Not alone was there a big attendance—that has become the usual thing—but it was so large that the doors had to be closed and locked to prevent more persons entering the hall. Not alone were retail sales good, but they were much better than last year, and on the average, better than previous years. Not only were the prospect lists large and the class of prospects high grade, but practically every maker expressed himself as better satisfied with the prospects obtained than at any time in three or four years, including too, the fat war years so-called.

Consequently, it was a success as a show, no matter how a person looks at it. As a display of the new cars which will be sold and used in 1922 it was equally satisfying, for all the new models were there, and these included a large number of desirable new features. Some of these features make for greater comfort, some are designed to give lower cost of operation, others to bring about silence of action or superlative performance, or to last longer. And all of them cost less.

The latter is really the outstanding fact for 1922, and the show emphasized it. Cars are much cheaper this year, many of them in fact are cheaper than pre-war prices, and a few are the lowest in their history. The show emphasized this matter of price because the majority of recent price cuts were made just before the end of the year, applicable as of Jan. 1, while a great many more were held back and announced just as the show opened so that their cars were shown to the public at this lower figure.

If one considers the combination which the new mechanical and body features give with the new lower prices, it is obvious that much greater value is being offered in the new year's product than ever before. And this should result in a much greater volume of selling than anyone would dare to predict last November or December in the light of the then known facts and conditions.

Yet when the end of the year was reached and the figures became available, it was discovered that it had not been such a bad year after all. In a subsequent issue, complete figures will be given for the number of cars in use, as has been done for many years past. The total 1921 production was 1,680,000 vehicles which is but 24 percent less than 1920, hitherto the banner year. This total included 145,000 motor trucks and 1,535,000 motor cars. Of real interest to the people who bought in 1921 is the fact that they bought their cars cheaper than those persons who purchased the year before, the actual average of all cars being $897 in 1920 and $702 in 1921. Another way of looking at this is that a much larger percentage of the total this past year were Fords, in fact the Ford production has been put down unofficially at 1,100,000, which would leave but 580,000 for all the rest of the industry, and would give Ford 65 percent of country's total output.

Similarly, the truck figures show that these were sold much cheaper than previously, the averages showing $1,273 in 1920 and $968 last year. Judging from the bold slashes which have been made in prices in the last month, it would seem that the 1922 average will be at least as much as the approximately $200 reduction effected in 1921 over the previous year.

Near the end of the show, while business was going very well with all makers, but especially with those of lower price, Dodge announced an indeterminate reduction, amount not given, effective as of Jan. 1, but not to be known until Feb. 1, which happens to fall right in the middle of the Chicago show. The result in New York at least was to shut off all sales in this lower priced class until some information was available as to amount of the cut and the new Dodge price. Rumor placed it all the way from $100 even to $200 even.

The new year is always a time for a good backward look at the year before, a time to take stock so to speak of what we have just done. The automotive industry did not hesitate to do this and besides deciding that good business called for better value (as exemplified in the better design and finish at lower prices), it figured out that a little more service would help the customer, and that a different attitude toward used cars was necessary as a help to the dealer and from the purely selfish standpoint of the manufacturer.

In general, all of the manufacturers in their branches and in cooperation with their dealers decided to give better service to car owners in 1922. This will be done through the carrying of more complete stocks of parts by all branches and dealers, the latter being forced to do this by their new contracts, and also by determined effort on the part of both to help the car owner more through personal touch, through advice or assistance of any kind, through better and quicker repairs, and in other ways. Fully and widely known, this of itself should help to sell many cars this year.

The used cars situation has puzzled the wisest heads of the industry and it now seems to be recognized that the manufacturers can not hang this on their dealers and wash their own hands of it altogether, for in doing this they place the dealer in a position in which he will try to dispose of the stock of used cars in which his personal funds are tied up and which are steadily becoming of less and less value as time passes, before he will push the sale of new ones, so that the ultra-selfish manufacturer will get less orders from his dealers.

On the other hand, the manufacturer who takes his dealer's used cars back to the factory and renovates them, helps the dealer to sell them more quickly, and with them disposed of the dealer is more ready to order new models to his financial limit. More than this, it has been found that the public will buy the factory-renovated old cars at prices enough higher to warrant doing this work, and will buy them more quickly and more cheerfully than they would the same cars "as is" but very much lower in price. Wrapped up in this situation seems to be the final solu-

tion of the used car business. That it is of considerable magnitude no one of complete knowledge of the automotive situation denies, in fact the best estimates place the number of unsold (and perhaps largely unsaleable) used cars in dealers and agents hands as of Dec. 1, at 150,000.

If the modest average of $330 be put on these cars, the whole amount tied up in them is in excess of $50,000,000. If divided equally among the country's 40,000 dealers this amounts to $1,250 each. And about three-quarters of the dealers cannot afford to lose that much as a result of any year's business to say nothing of such a lean year as 1921 seemed to them. Consequently, the dealers are very grateful for any help, or promise of help, toward moving this unfortunate inventory if it may be called that.

Getting back to the show, the old time fuss over decorations has disappeared and now the only problem is to get in all those who want to exhibit—which can not be done within the confines of any known and rentable hall in New York, and also to get in all the people who want to see the new cars, within the seven days allotted to it—and it begins to look now as if this could not be done either, for the doors to the show had to be locked this year on Thursday and Friday nights, to prevent so many persons jamming in as to make the place uncomfortable to all. Old timers said that this year for the first time crowds of people began to appear in the morning as soon as the doors opened. It is unfortunate that the detailed figures are not available now.

To delve into the car details, the new cars and new models of older cars showed that however else weight may be reduced in response to the popular cry of economy, it certainly will not be through the medium of the frame, or if so, not in a way which weakens that basis of the whole vehicle. Besides those makers like Marmon, Cadillac, Wills Saint Claire, and others known to have usually deep or unusually strong frame, no less than 10 new makes or new models were noted with frames 7 in. or deeper. The new Dorris has a frame 10 in. deep at one point and 8 in. throughout the greater portion of its length; the new Rickenbacker has an 8-in. frame; the new Ogren has a molybdenum frame 7¼ in. deep; the new Earl, in the small light car class has a 7-in. frame; the new Bay State car has a 7-in. frame; others with very deep frames include the new model Special Six Studebaker 7 in., new model Oldsmobile 8 with 7 in., new model Chandler 7 in., new Fox air-cooled car with 6½ in., new Buick Six with 6⅜ in., New Nash and Cleveland models with 6 in., and others.

Other mechanical changes noted were the greater number of overhead valve jobs, a majority of the new makes being of this form, while many older manufacturers have just turned to them. With this has gone a general cleaning up of the engine, which means greater enclosure so that the engine looks neater and cleaner. This has necessitated additional lubrication of engine parts from the circulating system of the engine, which will prove a boon to the owner as the number of places calling for his personal attention is less. This thought has been carried into the chassis as well, and many makes now have self-lubricating driving shafts, springs enclosed with lubricant inside (as grease) or supplied by engine pump (as oil). With these few exceptions, and a few others, the high pressure lubricating gun method is very general, almost universal.

Many wire wheels were shown, especially on sporting type cars, and the same is true of disc wheels. It would seem that no wheel now upon the market wholly satisfies both manufacturer and car buyer. Disc wheels look well and are easily cleaned, in fact need no cleaning, but are claimed to be noisy, reflecting all the noises of the car and its contact with the road. Both kinds were noted on the lower and highest priced makes impartially.

In body forms, the only new complete body forms were the light enclosed tops applied on touring car panels. These give the benefit of the fully enclosed car, as sedan, coupe, etc., at a fraction of the ordinary enclosed job. Several makers offered a doctor's coupe of this kind, two passengers, within $150 of the roadster price. As is well known the ordinary enclosed car is from $500 to $1,000 above the touring body of the same make and chassis.

In line with other simplifications, bodies are more simple. The ugly edge of a few years ago has entirely disappeared, and even outline moldings are going out. Many cars have no molding whatever, being built on consistently simple lines.

The old diamond upholstery is gone, as only one car in the show, a Franklin, had it. Practically all cars were upholstered with straight pipes, many with entirely plain smooth upholstery. In enclosed cars, it appears to be the up to date method of upholstering to use straight pipes for seats and back, making all quarters, doors, panels entirely smooth and unbroken.

Running boards too, are gradually disappearing, and being replaced by a pair of aluminum steps. Quite a large number of cars of the straight line sporting type were noted equipped in this way, and they included all the various body type, a fair number of sedan s as well as a large number of sporting roadsters and four-passenger tourings.

Bodies generally included more roadsters than for several years, and also more enclosed cars of one form or another. In short, if one excepted the sporting cars in four and six-passenger forms, it would seem that the touring car or as we now should call it, the phaeton, is gradually growing less in number, at least in the annual shows.

A tendency to capitalize popular unrest was noted in several departures from the conventional forms. These included two rotary valve engines in the show, two new air-cooled cars which were not in the show proper, a new steam car promised for the show but failing to arrive in time, several rather wild novelties in frame construction, a new final drive by friction, several motorcycle modifications which present the appearance of small automobiles when in use, a couple of new ultra-speed creations with the usual "guaranteed to do 85 m.p.h.," and some other novelties of lesser moment.

The show included 12 newcomers, these being Ambassador, Bournonville (rotary valve), Durant, Goodspeed, Earl, Handley Knight, Itala, Kelsey, Leach-Biltwell, Rickenbacker, Vauxhall and Wills Saint Claire. In the Commodore Hotel were shown these newcomers, Ace, Bay State, Fox, Frontenac, Gray, Neracar, Ogren and others, and on one of the upper or permanent exhibition floors of Grand Central Palace, the Page. Taken altogether, 20 newcomers following a somewhat lean year would seem to mean rather strenuous competition in 1922.

During show week, there was the usual run of association and society meetings, reunions, dinners and so forth, as well as a large number of dealer meetings.

Iowa leads all states in the total value of farm products and in number of motor cars registered on farms. The state is third in the average value of products per farm and in the number of motor trucks registered thereon.

Present and Possible Markets for Aircraft

BY HAROLD F. MARSHALL*

Where the Industry Stands Today and Why, What Can Be Done to Change the Situation, a Practical Future Program, Regarding Aviation as Transport

IT will be admitted that the airplane manufacturing industry is far from being prosperous right now. Granting that condition, the question is how can the situation be improved, how can a definite, practical program of market development be laid down? This is an attempt to consider one phase of it, namely the market most susceptible of immediate development, of results attainable in the present new year. After showing where this immediate market lies, an attempt will be made to outline the most effective mthod of development—taking into consideration first, the limited funds available for publicity and second, the fact that an advertising campaign should be self-supporting, although the good-will which is created may be considered as part of the profits.

A recent session of the American Society of Mechanical Engineers was devoted to the consideration of the problem of waste in industry. The waste report showed that market problems played a considerable part in the creation of waste. In the aircraft industry, the problem is mainly that of preventing future waste. If the ground work can be laid now to mould aircraft development; to compensate for the continued wasting away which has followed the over development caused by war, and to develop and stabilize the market, a healthy industry will be assured.

Aviation a Transport Industry

What kind of an industry is aviation? The general form is already recognized—for one thing, it is a strictly professional industry—creation and operation will and must be in the hands of the professional and out of the hands of the amateur, for safety's sake. But the professional must not forget that every other agency can and must be continually called into play for its development. If we must have an analogy for discussion let us remember that it is not the motor car industry—which, from the operating viewpoint is the greatest amateur occupation in the world. But aviation is basically a transportation industry and does resemble the other transportation industries—shipping and railways.

Since the general path for the future is fairly determined—what can be done in the coming year—to speed up the absorption of converted war equipment—to increase the production of new commercial machines—and to get commercial flying on a profitable operating basis.

Certainly data for the betterment of designs are not lacking—in no industry is there a richer supply of material of this nature. Nor are production facilities lacking—the opposite is rather true. Personnel is neither lacking, and now is an excellent time to absorb good personnel back into the industry. Even if the number of men returned to aviation activities is small it will help the employment readjustment that is under way.

The need for market development is thus seen to be the main problem of the industry. To find the most promising market and concentrate on its development—that is the problem on which the whole industry should center its atention.

The Marketing Problem

The importance of the marketing problem of an industry can be illustrated by reference to the men's clothing industry in the above-mentioned waste report. A condition was found which surprised even the engineers making the investigations. Unsatisfactory labor conditions and uneconomic overequipment of plants, which unnecessarily tied up immense capital, were traced directly to a faulty method of sales and distribution—in other words, faulty marketing methods. It is going to cost money to remedy this condition—a great deal more money than would be the case if they had planned their market instead of letting it "grow wild."

It is necessary to consider this problem from the viewpoint of the entire aircraft industry. It affects more than the sales department—it determines the condition of the other elements—advancement of engineering and design depends on finding an outlet for the "stock on hand" of brains as well as material.

Consider the aircraft market of yesterday and today. The sportsman can be disregarded—because of the professional nature of aviation he will take a continually smaller percentage of the output. Exhibition flying has passed—except the wingwalking type of exhibition which is doing the industry real harm. Governments have figured as the biggest customers and will doubtless continue to do so for some time. This in itself is a weakness of the industry—for no matter how you delve into politics you cannot make this a market of stable demand. As for the civil end of business—it will grow only as fast as you can convince the average man in the street that air transport and travel can be profitably used.

Convincing the Man in the Street

The problem of convincing the man in the street is of the greatest importance—it is a problem of demonstration and education. And this in turn is a matter of flying and advertising. Of all the factors retarding the development of the industry this lack of public confidence and knowledge is greatest. The seriousness of this fact is hard to realize. While progress in design, construction, operating methods, efficiency and even regulation is being made, ground is actually being lost in the minds of the lay public. As the public attitude can only be molded slowly, it requires continuous attention.

Consider the forces now actively molding public opinion on aviation. Advertising men and psychologists know that sensational freak performances do not count in developing confidence although they do arrest attention—the forces that count to this end are those which reach the daily routine life of the public.

How is aviation being brought into the daily routine life of the public? At present there are evidently four major influences acting. First there is the daily featured report of the latest accident. Second there is the "movie" of the latest wing walking stunt or other sensational achievement

* Formerly in U. S. Air Service in France. Reproduced from Aviation, New York, N. Y.

which makes Mr. Average American repeat that "aviation ain't for me."

Third there is the present "tramp" passenger carrier who travels like a small circus, with a poorly equipped plane and all the ear-marks of an under-financed pioneer and no evidence of good management. It is not meant to disparage these enterprises—but to point out the impression they leave. Fourth there is the man who occupied himself with aviation only during the war and dropped it like a hot potato at the end. He had only scratched the surface of facts—but his fellow laymen consider him an authority when he airs his misconceptions.

These influences have a cumulative effect—it is surprising the number of men that one finds who were once open-minded but have now reached a conviction that aviation is not going to meet their former expectations.

Demonstration and Education Needed

What is the best means of counteracting these influences? Demonstration and education—flying and advertising—is needed. But what kind of flying? Speed races? Cross-country records? The air mail service? These all help, especially in influencing the expert. But they do not help to convince the general public who in the end foots the bills and who are the ultimate purchasers of all transportation.

Not these activities, but the flight which takes the ordinary citizen into the air for his first "hop"—he first having been convinced that he should part with two, three or five dollars for the privilege—that is the basic builder of confidence. When he lands safely and comfortably, then you have an unequalled good-will asset and also, if profitably managed, a profit.

The advance made by commercial aviation in 1921 has been largely in a readjustment of prices. In the new prices the industry has a new working asset. But despite this change the increase in operation has been slight.

Passenger Carrying the Real Opportunity

The fleet of tramp and other planes carrying passengers offers the real opportunity of 1922 to the industry. Previously they have constituted a neglected field of effort—undercapitalized, poorly managed and without effective sales promotion. They have even hurt the industry at times. But in the hands of competent management, backed by all elements of the industry they offer a promising field for immediate development.

Cooperation should be given to the competent operators and new operating organizations put into the field. All should be backed with a well-planned advertising campaign which would have the joint object of getting prospects to the airdromes and into the planes and also building knowledge of and confidence in the industry.

The result of such activity will be an increase in the rate with which converted war equipment (now one of the ropes around the industry's neck) is absorbed, and an increased opportunity to put new designs into use. Lastly, the aircraft industry will have started to take control of its market, enabling the making of plans to develop it instead of letting it grow wild.

There is an absorption point to this passenger carrying market, but neither the 1,000 planes now operating, nor 5,000 nor 10,000 planes do not approach the absorption point in this country of 100,000,000 people. And long before this point has been reached the public mind will have been prepared for the acceptance and use of air transportation routes.

It is hoped that the mere showing of what this market offers will focus attention on its development during the coming year. Of course the exact method of carrying on operations cannot be laid down here as it will vary greatly. But the main thing is to assist ambitious operators and would-be operators to attain competent management and adequate publicity. For competent management it is necessary that all flying must be up to a high standard of safety and efficiency. While legal means of regulation is lacking the Aircraft Underwriters Association is a convenient medium for accomplishing this end. It should be urged and if possible, required, that every plane be operated under the code of this organization. The requirement might even be written into the contract of sale of aircraft for passenger carrying purposes. A standard of management and safety which can be fearlessly advertised will thus be attained.

The location of airdromes for passenger carrying should only be made after a study of the population within reach—a study of both the number and condition of the people and also the mediums of advertising which reach them. A central bureau could be maintained at small cost to supply this data to operators but to be successful this bureau must be made known to all operators. The manufacturers could well afford to supply this sale promotion service.

The nature of the advertising necessary to stimulate this passenger carrying is limited by the small funds available. The national mediums and the large city newspapers are to be avoided because of the cost of space. Certain Sunday editions might be advisable for stimulating fields near the very large cities. Enough space must be used in each case to make an attractive and educational appeal if the dual purpose of passenger-business and education is to be achieved.

Accessible Airdromes

The population should be within easy reach by automobile and street car travel of the airdromes. A moderate number distributed in several small towns is better than a larger number in the very large cities. Frequently a group of towns can be reached through weekly newspapers or through a daily where the city has only one or two dailies. These low-priced media offer the best and most economical field of activity for the immediate future.

The manufacturers and other elements of the industry could render a service here similar to the "dealer helps" rendered by manufacturers in other industries to the retailers. This service includes the entire preparation of the advertising—and leaves the operator with one expense only—the payment for space used. It also insures that all the advertising will be of the kind and standard that will best serve both the operator and the industry.

The intensive development of the passenger carrying service during 1922 offers, first, an immediate market that will respond to the means at hand; second, a means of absorbing converted war material; and third, a self-supporting method of creating confidence in the industry and the beginning of market planning which is a good method of stabilizing and strengthening an industry.

The paid attendance to the New York auto show exceeded 1921 by 17 percent, and nosed ahead of the 1920 record year by a small margin.

There are four plants in Czecho-Slovakia producing automobiles. These employ together about 100,000 hands and turn out 500 automobiles and 400 motor plows annually.

Hickory in Demand for Many Purposes

Hickory timber, although held in seemingly vast amount by the forest of the country, may soon become insufficient to meet American manufacturing and wood-working needs. The increasing demand for this valuable species, together with the scattered character of its growth in the forest, has resulted in merchantable stands becoming more and more inaccessible and difficult to log.

The forest service, United States Department of Agriculture, puts the country's present supply of hickory, distributed through 200,000,000 acres of forests, at 15,784,000,000 board feet. Of this the central states have 6,791,000,000 feet, the lower Mississippi states 5,171,000,000 feet, the South Atlantic and East Gulf states 3,183,000,000 feet, the middle Atlantic staes 412,000,000 board feet, the lake states 187,000,000 ft., and the New England states 40,000,000 ft.

One of the uses to which hickory is put is the manufacture of spokes for automobile wheels. The yearly demand upon the hickory reserves by this industry alone is tremendous, as there is much waste in getting the select stock necessary not only for spokes but also the rims of wheels.

Industries Compete for Hickory

For the most part vehicle and agricultural implement industries compete with the handle industry for hickory and ash. Those are located mainly in the middle west, but now derive most of their wood supplies from the south. A large number of far-sighted organizations purchased more or less extensive hardwood tracts some years ago, from which they are now able to draw at least a part of their wood supplies. To secure hickory, which grows scatteringly over large areas, the vehicle and agricultural implement industries originally maintained extensive buying, logging, and milling organizations in the south. They draw upon every conceivable source—farmers woodlots, small mills, large sawmills, and even specialized operations designed to secure hickory alone. These concerns in general carry in stock about a two years' supply of special-dimension stock.

Makers of automobile wheels say that they can still get the material required if they make sufficient effort and pay the price, but it is necessary to go farther and farther away for it. Many inquiries received by the forest service from vehicle implement makers, requesting information on possible substitutes for the woods used in vehicle making, is merely another indication of the difficulties in getting adequate supplies at the present time and of uncertainty as to the future.

Ten Different Kinds of Hickories

Hickory is often referred to as if it were a single species, like red gum or yellow poplar. In reality there are 10 different kinds of hickory trees. For hickory handle purposes those known as true hickories are most valuable. The pecan hickories include the water, nutmeg, and bitter nut varieties. The true hickories comprise shagbark, pig shellbark, pignut, and mocker nut. The handle industry is largely dependent on this last group of trees for its raw material.

The annual consumption of hickory by the handle trade is something over 120,000,000 feet board measure. Little, if any, of this material passes through the sawmills, for it is ordinarily cut and shipped to the handle factories in the form of log bolts or billets. All hickories do not give the same service when made into handles. The various parts of the same tree may show different properties, and the quality of the wood near the center is quite likely to differ from that nearer the bark.

The wood of the butt of a young hickory tree is of greater average toughness than it is when the tree is old. The wood of butt cuts of both old and young trees is tougher than that cut higher up the trunk. The handle manufacturers, for the most part, demand second-growth hickory, which consists of young stock of rapid growth.

Best Material for Handles

Hickory is the best known material for certain classes of tool handles, such as the axe, adz, pick, hammer, and hatchet. There is a certain strength, toughness, and elasticity to hickory which nature has denied to other commercial woods. Some are stronger, many are harder, but the rare combination of the qualities mentioned is lacking in all of them.

The raw material for handles in the form of short log bolts is sometimes split into handle blanks in the woods, but the usual practice is to rip-saw the bolts into blanks at the factory. The split-handle blank is considered superior to the sawed blank in that it insures a straight-grain handle. On the other hand, sawed blanks, though they are likely to show more cross grain, are more economical in the use of timber.

Hickory, due to its unrivaled properties of great strength, elasticity, and resiliency, is used exclusively in the manufacture of handles for golf clubs. The constantly increasing popularity of this sport has placed another demand on the hickory supply.

Automobile Manufacturing in Japan

The Japanese have manufactured motor cars and for a time they hoped to become independent from foreign manufacturers. It was soon discovered, however, that the cost of fabricating a complete car exceeded the cost of importing an American car, owing to the lack of facilities for working on a large scale, the relative inefficiency of the Japanese workmen, and the necessity for importing practically all the materials. The department of war has been anxious to have an adequate number of cars or chassis which might be converted to military purposes. On this account they put through a subsidy bill, designed to induce the Japanese to import and own cars.

The Tokyo bus service has been developed and expanded; it is, however, hard to see how the proposition could be made successful except with some sort of official support. It is also understood that official support has been given the Tokyo Gas & Electric Co. to enable it to import truck chassis and manufactured busses.

While Japanese made machines practically do not exist, it is customary to import chassis and to fabricate closed bodies for them in Japan; several companies, especially in Tokyo, do a good business in this line. This is accounted for by the climate, which makes closed cars almost a necessity, and by the burden of freight charges, which makes the cost of importing bodies such that the Japanese can compete successfully in this line.

The use of motor cars in Japan is generally limited to the large cities, owing to very poor roads, and the use of heavy trucks is hampered further by the frail nature of bridges. While most of the motor cars in Japan are found in the city of Tokyo, the market there has suffered severely within the present year from a local license tax assessed by the municipal administration, rendering the cost of the car almost prohibitive.

Lubrication and Its Importance to Industry

BY A. H. NOYES*

THIS is truly the age of machinery. The mechanical inventions of the past 50 years have been so marvelous as to be almost unbelievable. Watching one of the modern machines, with its giant arms, manipulating with absolute ease seemingly impossible loads, and another one performing operations delicate enough for a woman's fingers, it is almost impossible not to look for the god, sometimes the demon, who must be hiding behind the thing and working the levers.

But did you ever stop to think that all this mighty, intricate, and often delicate, machinery depends absolutely upon one tiny, insignificant thing, a thing that can not only stop every current and still every cog and every wheel, but damage the whole apparatus beyond repair. Does one person in a thousand realize that this tiny thing, which nevertheless, has the life of the whole tremendous mass of machinery in its power, is a drop of oil?

What irrevocable damage is caused by two metal surfaces sliding, rolling or grinding over each other, if there is no lubricating substance between.

Ever since machinery has been in existence, lubrication has been its companion, in fact it existed even before there were machines, when it was simply a case of reducing the power necessary to push one surface over another.

People did not know the word friction, did not even know what lubricant meant, but they did know that a little bit of fat or grease made the sliding a lot easier.

Even today, in the Island of Madeira, the natives' oxcarts have runners instead of wheels, and to assist the patient animal, the driver runs ahead with the "grease rag," with which he smears the cobble stones of the roads. From years of greasing they look like polished ebony.

It is a far call from a wooden sled sliding on cobble stones to two highly polished metal surfaces gliding over each other in a delicate machine, to the powerful piston of a great ship sliding back and forth in the cylinder pushing the whole weight of the ship before it, or the wonderful roller and ball bearings which do so much to reduce friction, and consequently the cost of motive power today

So it is a far call from the grease rag of the Madeira native to the marvelous automatic force feed lubrication of the present day's genius. If the yelling, gesturing native becomes a bit too tired of running back and forth with his "grease rag" it is only a little more sweat and effort from the patient ox that is at stake, no one is hurt, no damage done, only a little more time wasted, and time is a drug on the market with the natives.

But when two polished metal surfaces slide over each other, unoiled, they have a fatal tendency to stick together. Then what ruin! Bearings destroyed, cars delayed, ships at the mercy of wind and wave, time which is now worth millions, lost, contracts forfeited, and incalculable damage done.

Lubrication, then, becomes the sine qua non of industry. This seemingly unimportant thing becomes the prime importance, and must be considered from two view points. The first of these is the selection of the lubricant, and the second is the continuous application of this lubricant to the bearings, in the amount required.

Only a child would attempt to lubricate the highly polished bearings of an astronomical instrument with graphite, or to put crude oil in the delicate movements of a watch, neither would highly refined machine oil be of great service in the bearing of a cement crusher. But between these wide limits there is an infinite number of degrees of refinement, and much of the life of a machine depends upon the selection of exactly the right lubricant.

However, the utmost care and the most expert knowledge might be exercised in selecting just the libricant suited for a machine, and little use would it be if it never reached the bearings, a poor lubricant that reaches the spot is much better than a perfect one that stays in the oil tank.

This is where the element of human frailty formerly entered. The man with the oil can was often more important than the president of the company, his mistakes would sometimes be more costly, and both the president and the oiler were liable to error.

Men have such excellent "forgetteries." Add to that characteristic the universal tendency to carelessness and to "slighting the job," and you have inhumanity a woefully deficient oiling machine.

Some accurate and reliable lubricating instrument had, therefore, to be devised. There were, however, certain advantages that the human oiler did have: the machine which should replace him must incorporate all of these advantages to a higher degree, and in addition, it must not get out of order. So came into existence the force feed lubricator.

For instance, the lubricator must start work as soon as the machine starts and must deliver oil in proportion to its needs. A ratchet driven pump was found to best fulfill these two conditions.

The motor driven pump of course does not vary its stream of oil and the hydrostatic pump was no more successful. In the latter type the steam condenses in the condensing chamber and forces the oil drop by drop, to the bearings. This is successful enough when the machine is working slowly, but when it works rapidly, so much live steam is passing into the chamber that it does not condense fast enough and therefore does not feed the required amount of oil, just when the need is greatest.

Hence the ratchet driven pump has almost supplanted other types. It derives its power from a moving part of the machine and consequently stops and starts, and accelerates or retards its own speed, exactly with the machine. It therefore regulates its delivery in direct proportion to the needs of the machine.

Some of the pumps are fitted with worm gears. These are especially adapted to high speed steam units, such as direct connected light engines, and sawmill steam feeds of the reversible rotary type.

But the "man with the oil can" was not affected by heat or cold, and, if working in flying dust, he might rub his inflamed eyes, but he still kept on oiling.

The best modern force feed lubricators have heaters incorporated in them, and they are more oblivious to cold than any man. They do not solidify in winter, therefore, and they do not overfeed in summer.

The only way to avoid dust clogging was to place the oil in a solid box free from the working parts. This principle, as soon as discovered, was applied in the most advanced type of pumps. In this way it was made absolutely impossible for flying dust and grit to get into the oil and be carried to the bearings.

The working parts should be as simple as possible and they must be easily reached and repaired. One of the best models has a one-piece valve which eliminates prac-

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tically all troubles, for it is obviously impossible for a solid casting to get out of order. All the working parts of this model are on the outside of the oil reservoir which probably accounts for the absence of repair bills for continuous service.

The sight feed is one of the latest and most important devices added to the force feed lubricators. This sight feed leaves the action of the lubricator visible, so that an interruption in the flow of the oil is immediately detected. By its means, also, the engineer can see exactly the quantity of oil going to the various bearings.

The lubricators also have several chambers in the oil reservoirs, as many as required, in fact, and can therefore deliver different oils to different bearings. This is necessary to the life of any machine.

Pumps of all sizes are in use, from the very small, one feed pump, to the one holding several gallons of oil and delivering by 40 feeds. The larger pumps, or, as they may be called, pump systems, are designed for the lubrication they are to occupy.

The lubrication of an entire plant is thus controlled from a central point. The economic advantage of such a system is unquestionable. To such an extent is this recognized that practically all the large power plants and all marine engines are equipped with the automatic force feed pumps.

Although accuracy and reliability of action were probably the chief considerations in the mind of the originators of these pumps, yet they have been found to effect a very great economy in oil, as well as in man power. Some of the pumps are credited with saving from 50% to 80% of oil—a not insignificant matter in these days; and the cost of the wage which would have to be paid to an oiler doing the work of its 40 feeds.

Doubtless recent years have produced more marvelous and more intricate machines than the force feed lubricator, but none that have demonstrated a greater usefulness or a more perfect adaptation to the needs they were designed to serve.

New and Improved Ideas in Body Finishing

Painting the Body Ultramarine Blue

One of the finest colors for the automobile, and one widely used for cars of the sporting type is ultramarine blue. This is furnished by the manufacturers of color in three shades, the medium being the most popular. This is not a simple color to work with and many precautions are necessary to obtain a job which is wholly satisfactory.

To prepare and apply this color to the surface, proceed as follows: Bring the surface up with enough surfacing pigments—lead, roughstuff, etc.,—to make the work fine, smooth and level. If new work, apply one coat of primer, either bought ready to use or made in the shop, of pure raw linseed oil, stained with a little keg oil ground lead, adding to each pint of the mixture one teaspoonful of pale drying japan. Allow this coat three days in which to dry, and then sandpaper lightly with No. ½ sandpaper, and apply either a second filler coat purchased ready to use, or a lead coat made of keg lead and ⅓ raw linseed oil and ⅔ turpentine. Add one teaspoonful of coach japan to a quart of this mixture.

This coat should in good drying quarters dry to sandpaper in 48 hours. With hard drying putty go carefully over the surface and stop up all surface cavities and defects. After 24 hours apply first coat of roughstuff procured of the manufacturer ready for use except thinning, if too heavy in body, with turpentine. Apply 5 coats of this roughstuff at the rate, in good drying quarters, of two coats per day. The second day, after putting on the last coat of stuff, rub down with artificial rubbing stone and water to both a level and smooth surface.

Stand the surface aside over night, after rubbing, for the moisture to evaporate from it. Then sandpaper with No. 00 paper and apply a very nicely laid on coat of lampblack, using the black ground in japan. Apply two coats of this black in a day, one in the morning and the second coat late in the afternoon.

Now prepare the ultramarine blue by thinning enough of the blue with turpentine only to go over the surface. Apply with a camel's hair brush. This coat will dry perfectly flat—that is, without any gloss. Now mix the blue paste in elastic rubbing varnish, using it in the proportion of ¼ pound of color to 1 pound of varnish. Before adding the color to the varnish, however, thin to a cream-like consistency with turpentine. Mix everything in a very thorough manner, and thereby secure a smooth, free-working color varnish.

Apply this coat of blue with a 2 or 2½-in. chisel-pointed badger-hair flowing brush. After application observe how the varnish color saturates the flat blue and brings out the color to the same splendid tone that appears in the moist color in the container.

Perhaps, to get the required solidity of color it will be necessary to apply a second coat of the blue varnish color, in which case the second coat should consist of precisely what the first coat is composed of. Usually blues are difficult to produce on the surface in the same depth and beauty of tone that appears in most pigments, and they are also very easily affected by the varnish used over them. To overcome this it is a wise provision to use a little of the color in all the coats of varnish except the finishing coat.

More Attention to Chassis Needed

In repainting automobiles, and especially on repair work, many painters fall down through not giving sufficient attention to the details of this work. When carefully done it is most satisfactory to the average owner, and being well pleased, he will recommend the shop to other drivers or owners.

If for no other reason than to have an even, uniform job, the chassis should be done as carefully as the rest of the car. If not done so well, the fact that the lower part was slighted will show and give the vehicle a shabby appearance.

The well-finished vehicle, be it horse drawn or horseless, is one in which a correct balance in the character of the finish is developed and worked out in complete detail. That an exceedingly large number of painters have permitted themselves to be drawn away from this practice, through, in many cases at least, sheer carelessness, cannot be denied, for the cars show the neglect. As a matter of business, not to mention other reasons more than suf-

ficient, the practice should be discontinued, and a better grade of work applied to the chassis. They merit it; and it will pay in the satisfaction of work well done and in the prestige it will confer upon the business.

These under parts, in the first place, should have a cleaning most thorough and complete; a solvent of turpentine and crude oil, one part of the latter or two parts of the former, sufficing for all moderate cases. Now and then will come along a car with the parts so incrusted with grease and road dust and other accumulations that nothing short of hot water and sal soda fused together in a form of sufficient strength to loosen up the old crusty patches of grease and dirt, and enables the workman to flake them off, will fill the bill. This is a job that will need to be estimated on closely; otherwise it will be found without profit. On the average it is worth not less than $5 per car to clean the chassis for painting and varnishing. Then when clean, if the car is to be painted, they had best be scraped and sandpapered enough to make them clean cut and with all surplus old paint conditions cast off, and a smooth and solid foundation prepared for the coats to follow:

For a thorough job of repainting the first coat applied to the running parts will need to be composed of some good surfacing material and a tenacity of wear and a capacity for holding out all other coats going over it. Many painters use a combination of brown oxide paint and white lead; equal parts of each working right and wearing most durably. The oxide is not as good a surface paint as the lead, but it is a very durable pigment, and supports other coats strong and sure.

In applying this pigment brush it out clean and smooth, and when it has dried putty all places needing stopper material. Then in due time get after this putty with sandpaper and cut it down level with the surface in general. Now go over the coat of lead and oxide paint with some fine sandpaper to break down the nibs and particles of dirt and grit, and to smooth up the surface nicely. Next lay on a coat of lead shaded to fit the final color to be applied. Make this lead mixture thin enough to flat out under a camel's hair brush and use only enough raw linseed oil to bind it securely to the surface. Thus make it a flat coat in the matter of drying—that is, a coat to dry practically "dead," or without the customary egg shell gloss. When dry this coat will scarcely need more than a light going over with No. 0 paper to smooth out the deficiencies of the surface and to refine the work in a way to properly meet the requirements of the case.

Now we are ready for the color. The choice of a color will not be difficult if we take the body color as a guide for the chassis color. Always make the color for the running parts lighter in shade than that used upon the body of the car. And so far as possible, use the same color for lining the chassis as is employed upon the body. It is, of course, allowable to employ a two-line striping for the chassis, and in this case one of the lines may be of a color entirely different in shade and tone from the line used above the running parts. One coat of color, and then one coat of strong varnish, followed by a weaker one in the matter of color strength will generally suffice to fetch out the complete strength and tonal effects of the color. On this coat the striping may be done, after which one coat of clear rubbing varnish will make the surface in its prime for the final rubbing prior to the application of the finish. In the surfacing of the varnish aim to get a uniform reduction of the varnish. Wash very clean, tooling out all the broken spaces, etc. Then flow on a coat of finishing varnish, using all the varnish the surface will carry.

Quickly and Easily Made Waterproof Glue

Painters and automobile body builders use so much glue, and use it for so many different purposes that it is important to know how to waterproof it, as this must shed water in some circumstances. A waterproof glue may be made from three parts of gum shellac and India rubber one part by weight, these constituents being dissolved in separate vessels in ether, free from alcohol, subject to a gentle heat. When thoroughly dissolved the two solutions are mixed and kept for some time in a vessel tightly sealed. It is further claimed that this glue resists the action of water, both hot and cold, as well as most acids and alkalies.—Exchange.

Preserving Color Purity on the Car

This is a subject deserving careful attention on the part of the painter. It is an easy matter to lose the natural lustre and natural purity of any given color. More difficult today perhaps than ever before for the reason that a much larger list of exceedingly delicate and sensitive colors are now employed than formerly. It is for the purpose of preserving this color purity and, in a sense, adding to it, that varnish-color has come to be recognized as the piece-de-resistance, in all fine car and carriage paint shops.

For the purpose of preserving this purity of color a certain percentage of it is used in all but the final coat of rubbing-varnish, and where striping is not applied the color is used even in this last rubbing coat, thereby preserving its original purity of shade and tone to the very end of the chapter. The treatment of color coats should be of the most thorough character. One point especially seems worth while emphasizing, to wit: that all coats of color should be thoroughly dry before being coated with varnish or varnish color. It is a common experience—far too common, in fact—to find a field of color showing various shades. This is the result of applying a second coat of color before the first one is dry through and through. There are many very elegant shades of green which if varnished over before they have reached a perfect dry state will develop anywhere from two to four different shades of the same color. The color on the car or carriage when it is given time to dry properly before varnishing will look and should look precisely as the same color looks in liquid form in the mixing cup. In this condition you have color purity in its original and perfect shade. In the case of using a specially shop-mixed color as it so often becomes necessary to do it is well to mix a sufficient quantity at one time to complete the job through all its various coatings. Some of these colors are very difficult, if not impossible to match. Because of this a quantity amply sufficient to meet the requirements of the individual job should be prepared. This will remove the danger of getting an off shade or shades on the job. A uniform shade of color measures in large part the real excellence of the painter's work. A lack of uniformity in color brings the entire finish into disrepute.

Another point to be enforced in connection with these modern car and carriage colors is the need of plenty varnish protection. The painter's responsibility with respect to a well-finished job does not cease upon payment for his services. This being true, it should be a part of his business so far as possible to keep the work under observation and to urge revarnishing when such work is needed.

Harmony in Car Upholstery

At the body engineering session held during show week R. C. Quaintance discussed harmony in car upholstery as follows:

It cannot be emphasized too strongly that, in the natural expression of refined taste, the purer color must be used sparingly and with great care. The tints and shades or tones are to be favored. The chief function of the purer colors is emphasis only or, if one can so refer to it, the purer colors are for punctuation only. While it is agreed by most students that complementary colors are harmonious, there are certain conditions that must be considered, chief among which is area. For instance green is the complementary of red. For certain purposes this combination is an excellent one. When applying it to a closed-car interior, we must neutralize the dominant hue. Professor Munsell has compiled a color chart which shows that red is twice as strong as green in what he terms "chroma." In this instance, he says, we will regulate the area; so that our dominant color is green and considerably lowers the value of the red by darkening it. The green itself might well be grayed, preferably to an olive, and we then find, in applying the two complementary colors to a closed car interior, that the color scheme has worked out to an olive-green cloth with a maroon stripe. It is a combination that is suggestive of spring and of the garb of nature and is representative of life, youth and freshness; a combination of warm and cold colors that is agreeable and restful, since the maroon stripe supplies sufficient life to tone up the combination.

In passing it may be well to remark that nature supplies a wealth of harmony which must be studied to be appreciated. The student will observe quickly that nature employs a relatively small amount of pure colors. Even the beautiful sunsets are devoid of pure colors; all of the beautiful effects arise from ever-changing combinations of tints and shades.

A point to be borne in mind in regard to harmony in car upholstering is the fact that the less obvious the color element is, the most quality the different tones possess. This is applicable equally to color harmony in other fields.

The warmer tones are to be preferred for use in a closed car as against the colder tones. By those who have understood the subject, the warmer tints have been selected with a view to making the interior cheerful and inviting in its appeal, and to make it as pleasant as a well-appointed drawing-room in its season of greatest usefulness, winter. The same interior can be made cool, quiet and restful during summer, by the use of slip-covers having a color scheme based upon the cold side of the color circle. Slip-covers serve other purposes, chief among which is the protection of the upholstery from dust and dirt during periods in which the windows frequently are lowered when driving.

A still different kind of color harmony that, I am sorry to say, is extremely popular with many car builders, is what is temed a mono-chromatic group. This is made up of two or more tones of the same color. It is the most unobtrusive and conservative harmony scheme possible. It is always safe, but seldom interesting. There is, however, an even more severe treatment, that of employing a single solid tone. This practice requires painstaking care in the selection of laces, curtains, curtain cords and other trimming accessories to insure perfect matching. I have seen some excellent examples of this type in the products of custom body builders, but I do not commend its use to large manufacturers. This treatment would not wear well with some personalities; it would become extremely monotonous and probably tiresome.

In the mono-chromatic harmonies, those employing two or more tones of the same color and any other schemes except the solid tone, it is possible to give the interior that natural balance of light over darkness that is considered of prime importance in all decorative fields. In this case the floor covering would be of the darkest shade, the body cloth a trifle lighter and the trimmings and head lining, if one is used, of a still lighter shade. In interiors of this nature, it is possible to make the color scheme interesting by the use of one or more bright spots such as an enameled handle or vanity case, or by using other interior fixtures. This should be of a color complementary to the dominant color. If we must have more mono-chromatic car interiors, let us at least liven them up. If we insist that the cloth manufacturer supply us with fabrics containing two or more neutral shades, then let us liven up the interior by the use of color in other interior fittings.

I wish to urge, however, that we be reasonable. Judging from the descriptions I have read of the cars shown at the recent Paris Salon, our European friends have achieved some remarkably grotesque discords in this line; apparently, this is a reaction from the recent war. Some of the cars shown must have been extremely ludicrous; nevertheless, we can learn much from the Europeans. Not all of their creations are to be classed as freakish; in fact, all Latins are more artistic than Saxons as a rule and, generally, they are much more fond of color.

There are three general types of fabric, cotton, wool and mohair. Of the first, cotton, little need be said. Cottons are used generally in the cheaper cars only, although the cotton velours had an extensive run in the medium-grade cars during the war period, as did the cottons also. These velours, while giving a rich luxurious effect, are not really serviceable. The mohairs woven from the hair of the angora goat are extremely serviceable and have enjoyed several years of popularity. But the fabric that seems to be the most desirable from all angles of style, wearing quality and appropriateness is the various kinds of woolen cloths. They vary in weaves and weights and a particular type can be found for any upholstery purpose.

A point to be borne in mind when selecting fabrics is that any pronounced figure will soon grow extremely tiresome. The eye requires complete rest in a closed car, rest from the continuous motion outside. The influence of the interior should be one that is felt rather than seen; for this reason the brocades, tapestries and chintzes, or other furniture upholsteries, have no place in the correctly appointed motorcar. The pattern should be small and unobtrusive and appear in the body lining only.

Some manufacturers have experimented extensively with woolen cloths and today are weaving a cloth on looms especially designed for automobile fabrics. Special finishing machinery has been built to impart a broadcloth finish to all woolen cloths. A fabric that promises to become extremely popular is the new worsted cloth. Some of this is all worsted, and some grades are only worsted faced. These cloths trim well and have unusual wearing qualities. Another new fabric that has great promise is the mohair sateen, a flat woven mohair. This can be made in a wide variety of shades and various patterns and,

strange as it may sound, is guaranteed by the manufacturer to outwear the car.

In conclusion I want to enter a plea for more color; more color in the interior and more color in the exterior. We literally have worked the funereal color, black, to death. For years we have painted the majority of our cars black. We have had too much of it. We should brighten the cars with color. As a result of the continued practice of using black, we have killed many an owner's pride in his car. When one drives home in a new car these days, it is impossible to feel that one is creating any stir in the neighborhood. In fact, one's neighbor is very apt to remark over the back fence, "I see you got the old bus washed up."

Modern Upholstery

(Continued from Page 15)

into the seaming lace, with the lace carried around the sides, and the cloth sewn up into the lace afterwards.

All half diamond and swell pleats should be machine-sewn, and the hind quarters sewn up in straight flutes, the material being sewn to the canvas; then stuff up on the bench all squabs except the inside quarters and the inside front, which are better stuffed in the body. The quarters can now be fixed into position and lightly stuffed up, then fix in two rows of 8-in. springs, 7 in a row, to come in the required position behind the swell and another row of 5-in. springs just behind the top row of buttons, preparatory to fixing in the back squab, stuff up the top nice and even. This squab should finish off with the appearance similar to that shown in section in the sketch.

The head lining is now ready for fixing, the elbows being stuffed up on the bench, and the covering underneath the elbow piece being only tacked along the back of the elbow. The angle plates for fixing having been fixed to the body, a part of same will prortude above the quarter squab; two slits should therefore be made in the underneath material on the elbow for the angle parts to slip through, and the elbows can then be screwed into place and finished off.

Sometimes it may be found advisable to put in the head lining first, in which case the back and quartres of head would be better made with the seam in the corners and then sewn by hand in the body after the back squab is finished off; however, the trimmer will arrange that himself; there are several points which govern this procedure.

When fixing the pockets on the doors and quarters, it is advantageous to place a layer of wadding on first, as this helps to give the work a good appearance, and also takes away the hard feeling. The inside front is finished off with seaming and pasting lace up the sides and across the waist rail, the flap being fixed over the folding seats and finished across the body with seaming and pasting lace. The carpets are fixed last, and the bottom carpet fitted, and at the same time the hat cord and paper net are fixed in position in the interior front roof.

The head leather should be fitted neatly, care being necessary to fit the darts correctly at the corners of the domed back stick. This is a very important point to watch; likewise, to fit the roof seam carefully, so that the head leather does not sag between the sticks, and also does not allow the back corners to sink in a hollow fashion; to prevent this, this part should be padded up a little.

All interior fitments and door stops can now be fixed, which will complete the job.

Brussels Automobile Show

The fifteenth Salon de l'Automobile et du Cycle, held at the Cinquantenaire in Brussels, Dec. 3-14, 1921, though not specially remarkable from a mechanical standpoint, was interesting on account of the increased participation of French and Italian exhibitors, the larger number of small 10 h.p. cars from all manufacturers, and the comparatively negligible representation of the American automobile industry which has, notwithstanding, exercised a probable influence on the Belgian automobile market.

Only one high-priced American car was shown, and then only casually as an example of Belgian carriage work. Four makes of inexpensive and medium-priced American passenger vehicles occupied stands, two American trucks were shown, four American tractors, and no American motorcycles. The absence of the last is the more regrettable, since they are at present favored by a profitable market. American tire, oil, and accessory agents were well represented.

From the standpoint of sales, the exposition was mainly notable for the general attention given by buyers to the light and medium priced vehicles of the 10 h.p. class. Practically all Italian factories exhibited models of this sort, while several of the better known French makers are endeavoring to obtain a share in the market so far practically monopolized by a well-known series produced French mark. In Belgium the Fabrique Nationale has resumed the production of its 8 to 12 h.p. 4-cylinder model, and the Metallurgique Works offer a 14 h.p. type, while the smaller Nagant plant at Liege has entered the market with a 10 h.p. experimental model having center control and brakes of the Adex type on all four wheels. Several small Belgian shops exhibited light models, among them the Auto-Mechanique (Liege), which has been organized by English capital, showing a 10 h.p. chassis with three-seated coupe body and a four-seated touring body.

The prices on Belgian light cars are not such as to threaten American sales seriously. Some of these models are simply prepared as feelers to determine whether a market exists. Numerous cars used for exhibition purposes by European manufacturers are built solely for the large salons, while the average American exhibitor confines himself to stock cars and possibly one specially polished or painted chassis.

In general it may be considered that the opportunities for light and medium-priced American cars in Belgium are distinctly favorable. The cars held in Antwerp warehouses have been for the most part disposed of.

B. B. Bachman Heads S. A. E.

At the annual meeting of the Society of Automotive Engineers in New York in January the following officers were elected: president, B. B. Bachman; first vice president, J. V. Whitbeck; second vice presidents, F. E. Watts, H. E. Morton, O. W. Young, V. E. Clark and C. B. Segner; treasurer, C. B. Whittelsey; councilors, Lon R. Smith, C. F. Scott, H. M. Crane and W. R. Strickland.

President-elect Bachman, who has for many years held the position of chief engineer of the Autocar Co., has served as chairman of the standards committee, and has been actively interested in the work of the society almost from its inception. He has been an officer of the society and as such a member of the council for several years past, and was at one time chairman of the Pennsylvania section of the society.

Manufacture and Application of Automobile Varnishes

L. Valentine Pulsifer presented a paper at the body engineering session on the Manufacture and Application of Automobile Varnishes and Paints. The ability of an automobile finish to remain new, he said, is the product of four elements, the slighting of any one of which is bound to be fatal to satisfactory results. The four elements are the proper quality of the materials, engineering of the system, method of application, and care of the finish.

The automobile manufacturer is interested particularly in two phases of this preservation, the engineering of the system and the method of application. Given the proper quality, the manufacturer can secure good results if he properly lays out the system of application.

Five basic materials are used in automobile painting; those for priming, surfacing, coloring, rubbing and finishing. Each performs a distinct and different function and all are necessary to a complete painting operation.

The primer forms the bond between the surface to be painted and the subsequent coats of material; it is the foundation of the whole structure.

It must be of suitable nature to perform its duties properly and be applied over a surface properly prepared to receive it. The surfacing materials are used for the purpose of building up a smooth surface on which to apply the color, rubbing and finishing coats. There are two types, those surfaced by sandpapering and those by pumice. The latter are tougher and more dense and, although they require more time and labor, give more complete and durable results. Coloring materials include the so-called ground colors, Japan colors, flat colors or body colors. They form a dense, opaque ground on which to apply the subsequent rubbing coats. They are extremely rapid in drying, show no gloss and should be semi-porous in nature to permit the varnish of the first rubbing coat to penetrate to a certain extent. Rubbing materials comprise all types of clear and colored rubbing varnish and a preponderance of gum in their make-up gives them a hardness that permits of their being rubbed to a smooth surface. This is done preferably with pumicestone flour, a felt pad and water. They range from materials that air dry to rub overnight to those that take four days to reach the requisite hardness for proper rubbing down. The colored rubbing varnishes are either factory made by grinding the proper dry pigment into the varnish or shop made by the careful addition of japan color to the clear rubbing varnish. The type of rubbing varnish selected is gaged by the character of the work, the slower and more durable grades being indicated for finer types of finish.

Finishing varnishes used in automobile work represent the most highly developed type of oleo-resinous varnish used for any purpose. They must work and flow faultlessly, dry within a reasonable time, present a surface of mirror-like smoothness and possess adequate toughness and elasticity to insure long life. Hardening to a final thickness of less than .001 in., they must protect the whole paint and varnish structure against all the elements, and only too often against the abuse or neglect of a careless or ignorant owner.

Body varnishes should be chosen for their paleness of color, freedom and safety of working, speed and perfection of flowing, speed of drying and hardening and relation to durability, fullness of body and brilliancy of finish. A different type of finishing varnish should be chosen for the hood, fender and wheels from that used on the body, since there is need for a varnish more resistant to the action of mud, water, oil, grease and soap that is required on the body.

In laying out the system for a given job it cannot be over-emphasized that the five basic materials must be chosen not only for their individual merit but for their ability to pull together. To obtain the proper correlation of the various coats the elasticity of the succeeding materials should be gradually decreased from the primer to the flat color and then gradually increased up to the finishing varnish. This result is obtained by using an elastic primer. Next, a coat intermediate in elasticity between the primer and the surfacer is used; it is the so-called half-and-half or elastic roughstuff. Then the surfacer itself, possessing less elasticity, is applied and next the flat color possessing practically no elasticity. This should be followed by gradually increasing the elasticity of the rubbing coats produced by making each succeeding coat lower in japan color or pigment content and, finally, capping the whole with a finishing varnish possessing the greatest degree of elasticity possible.

In the discussion which followed Mr. Pulsifer stated that the dipping process is used principally for the application of black baking japans. Spraying by air brush or air gun affords the best method for the application of the primer surfacer and flat color coats. Flow coating is a method of applying rubbing and finish varnish that was first tried on a very small car and now is in use in a number of large plants producing higher-grade cars. It has to be used cautiously, as in a great many instances it is not highly successful in obtaining the desired fullness and durability. Flow coating finishing varnish results in a thinner risidual film than is produced by the proper brushing of the same varnish. The lack of fullness of a flow coated finishing varnish can be corrected by extreme care, but such care is hardly possible with piecework.

If time and space were no object there would be no choice in final results between proper air drying and proper forced drying. Care must be taken, however, against too great an application of heat or too rapid application of the heat, or too little moisture content for the amount of heat used, all of which will cause case hardening of surface rather than proper hardening thoroughout.

Surfaces in finishing are either sandpapered or rubbed with block rubbing stone and water. Sanding surfaces should not be rubbed along with the use of water because they are too porous. The best practice on rubbing coats is by felt pad and water, as it gives the best combination of appearance and durability.

Pulsifer emphasized the fact that too many coats is just as bad as too few because of the tendency toward cracking and chipping under the influence of the weaving of the body. He stated that for a long time it was considered meritorious to apply a great many coats to a body, but that experience has brought out the fact that this is not in the interest of durability.

Another point which was brought out into the discussion is that in cleaning it is much more preferable to use benzol than gasoline, because of the greater volatility of benzol. The same primer can be used for aluminum as for steel, but owing to the nature of aluminum surface it is highly important that it be properly cleaned if anything like a durable paint job is to be secured. It is particularly necessary that any solder which may be present on the body be cleaned off before the primer is applied.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Oakland Motor Car Co., Pontiac, Mich., has just completed an addition to the motor plant at a cost of approximately $500,000. This addition has added 200,000 ft. of floor space for manufacturing purposes. In all the plants of the Oakland Motor Car Co. there is a total of 1,270,500 sq. ft. of floor space. This area composes the entire floor space of the eight plants of the company at Pontiac and extends over a plot of land of approximately 28 acres.

Durant Motors Co., Oakland, Cal., a subsidiary of Durant Motors, Inc., New York, is awarding a number of sub-contracts for its new two-story plant, at East Fourteenth street and the city limits, 800 x 800 ft., including four wings. Work is under way. It is estimated to cost about $750,000, including machinery. The P. J. Walker Co., Monadnock Bldg., San Francisco, has the general contract. H. J. Brunnier, Sharon Bldg., San Francisco, is engineer.

Willys-Overland Co., Toledo, will concentrate operations at the plant of the Wilson Foundry & Machine Co., Pontiac, Mich., a subsidiary, for the manufacture of motors for the Willys-Knight automobiles. The plant will be enlarged and considerable equipment removed from the Willys-Overland works at Elyria, O., for installation. It is expected to adopt the increased operating schedule early in February. The Willys company will utilize two of the buildings of the former Flanders automobile plant at Pontiac for the assembling of Willys-Knight motors, and equipment for this purpose will be provided.

General Motors Corp. is still shipping its surplus machinery to Detroit and it is expected that this will be placed on the market early in January. The number of machines, originally estimated at 1,600, has been increased to 2,500 to 3,000. However, as the machines are shipped in, superintendents of the various General Motors plants are picking out tools that have come from other plants that they can use so that the total number to be placed on the market may not be much over 2,000. These will be sold through dealers.

Hanson Motor Car Co., Atlanta, Ga., is arranging for the purchase of a site at Detroit for the erection of a new plant to manufacture a six-cylinder automobile, to be marketed at about $1,000. It is proposed to maintain the works at Atlanta, as heretofore. Arrangements will be made, also, for parts supply, to include the erection of a new plant at Detroit for this purpose, or the purchase of an existing works. The company proposes to increase its capital from $25,000,000 to $50,000,000. George W. Hanson is president.

Hanover Automobile Co., Hanover, Pa., occupying the former plant of the General Gas & Electric Co., is planning for enlargements to provide for a capacity of 1,000 cars a month, designed to sell for about $300 each. It is expected to give employment to about 1,500 operatives.

Interstate Car Co., Massachusetts avenue and Sherman drive, Indianapolis, is planning for the erection of a one-story foundry for the production of iron castings, estimated to cost about $25,000.

Allen Motor Co. has been sold to Frank Shaw of Chicago, representing the Continental-Commercial Bank, the sale including all assets excepting cash in bank and notes receivable. Included are the plants at Columbus and Bucyrus, together with all finished cars, partly finished cars and raw materials. The Bucyrus plant was the motor manufacturing concern. Shaw expects to operate the company, making automobiles, but has not announced detailed plans.

American Car & Foundry Co. has organized an automotive wheel division for the manufacture of disk and wire wheels for passenger cars, and a line of wheels for trucks, in the Russell avenue plant, Detroit. The wheels are the design of C. S. Ash and will be known as Ash wheels. Ash will be in general charge of manufacturing and merchandising the product.

Gray Motor Corp. will build 23,000 of its new light four-cylinder cars in 1922 and has already contracted with dealers to take over this number. These for the most part will be built and assembled in the Detroit factory. With the establishment of its assembly branches throughout the country the company will go into production on a basis of 200,000 cars a year.

Dayton (O.) Malleable Iron Co., has purchased the Canton, O., plant of the Timken-Detroit Axle Co., Detroit. This is a malleable iron foundry which has been used by the Detroit company for making automobile castings. It is stated that the Dayton company will operate it as a railroad specialty shop. The transfer of ownership will take place Feb. 1.

Ingram Motor Co., New York, care of Joseph Ingram, president, 2 Rector street, will construct by day labor its new automobile manufacturing plant at Norfolk and Atlantic avenues, Egg Harbor, N. J. It will be two and one-half stories, with power plant, totaling 40 x 200 ft. H. B. Perry, company address, is engineer.

United States Automotive Corp., Connersville, Ind., operating the Lexington Motor Co., Ansted Spring & Axle Co., Connersville Foundry Corp., all of Connersville, and other automotive organizations, has disposed of a bond issue of $1,750,000, the proceeds to be used for financing general operations, etc.

Cotta Transmission Co., manufacturer of parts for motor vehicles, has been incorporated with a capital stock of $750,000. The new company takes over the plant of the old and will operate along similar lines, but with new officers and directors. The new name will be Cotta Transmission Corp.

A. J. Miller & Co. plant at Bellefontaine, O., hearse manufacturers, has been sold to a newly organized company, the A. J. Miller Co., which has been authorized by an order of court. Albert Riggs, receiver, will become president of the new company which will manufacture funeral cars.

Champion Ignition Co., Flint, Mich., manufacturer of spark plugs and other ignition equipment, is planning to devote a portion of its plant to the manufacture of speedometers and parts, and complete precision machinery will be provided for this purpose. Albert Champion is president.

Franklin Automobile Co., Syracuse, N. Y., will equip a portion of its plant for the manufacture of a four-cylinder, air-cooled motor, automobile, weighing about 1,000 lb., and designed to be sold for $1,000. It is proposed to develop an output of 100 cars per day. H. H. Franklin is president.

Chief Motors Co., Port Huron, Mich., will install several new machines to bring its production up to 100 tractors daily. It was recently amalgamated with a Cleveland motor company and a concern in Sandusky, O., under the name of the Whitney Tractor Co.

Auto Specialty Mfg. Co., St. Joseph, Mich., is having plans prepared for two one-story buildings, 80 x 325 ft., and 80 x 162 ft., estimated to cost about $100,000, with machinery. Davidson & Weiss, 53 West Jackson boulevard, Chicago, are architects.

Curran Motor Radiator Co., 401 Calvert Bldg.. Baltimore, has acquired property on Hanover street as a site for a new plant, 40 x 180 ft. The initial unit will cost about $30,000.

Ford Motor Co., Detroit, has awarded contract to Everitt Winters, 742 Book Bldg., for one-story addition at River Rouge, 68 x 484 ft., with lean-to extension, 60 x 230 feet.

Packard Motor Car Co., Detroit, expects to go into production some time this year on a ¾-ton truck which it has been designing and experimenting with for several years.

Milburn Wagon Co., Toledo, O., has resumed production of electric trucks which was suspended in 1917. It is producing the chassis for ½-ton models.

Bullard Machine Tool Co., Bridgeport, Conn., will manufacture motorcycles on an extensive scale.

Body Builders

Auto Metal Body Corp., building Hupmobile bodies, plans an early enlargement of its plant at Springfield. The All-Metals Co. is negotiating for a building in which to engage in the systematic manufacture of bodies. Springfield Coach Works has bought the land and buildings on which its factory is located, and in the near future will erect a structure specially adapted to its needs. Smith-Springfield Body Corp. is being operated at its full capacity of 250 employees. This concern is getting an increased number of orders for bodies for foreign cars, a trade lately revived after being interrupted by the war.

Automotive Body Corp. has been organized by former officials of several body companies to build custom bodies and special four-door sedan bodies for Ford cars. It will also do body engineering and build cabs and bodies for commercial cars. Davis Baker, formerly with the Wilson Body Co., is president; Paul Block, formerly wtih the Racine Mfg. Co., is vice president; and C. M. Mulholland, secretary and treasurer. A plant will be established in Detroit.

Fisher Body Co. of Ohio is reported running night and day on three eight-hour shifts at its Cleveland plant. To its working force 2,000 employes have recently been added. While some of its business is coming from the parent company, Fisher Body Co. of Detroit, which guarantees $20,000,000 gross business annually, a great deal of it is said to be coming from independent automobile companies, particularly in the Cleveland district.

Jacques Manufacturing Co., Philadelphia, manufacturer of automobile bodies, has moved into its new factory building in that city, which affords greater facilities to care for 1922 business. The company has specialized in closed cars on a production basis, the output during the past year going into the product of four of the makers of cars in the $3,000 to $5,000 class.

Amiquoid Co., Inc., a new organization to manufacture automobile tops, etc., has leased a group of buildings from the Rogers & Hubbard Co., Portland, Conn. O. H. Chase will be in charge of production and A. C. Rader will be associated with him.

Fulto Auto Body Co., Atlanta, has opened its new plant manufacturing custom made bodies and sport bodies for the Ford chassis. The company is headed by Charles Drager and sells mainly through dealers in the southeastern territory.

C. R. Wilson Body Co., Detroit, has purchased the Henry E. Hund Co.'s trimming and painting plant which will enable the company to furnish automobile bodies complete. Henry E. Hund will remain in charge.

United Automotive Bodies Co., recently organized at Danville, Ill., announces that it is in no way connected with the Ohio corporation of the same identical name with offices in Cleveland.

Hackney Brothers' Co., Wilson, N. C., sustained a loss estimated at close to $350,000, including equipment and stock, when fire destroyed its automobile body and wagon plant.

Autobody Co., Lansing, Mich., which is producing 30 motor car bodies daily, plans to increase production early in the spring to 100.

Hoover Wagon Co. has changed its name to the Hoover Body Works. It is proposed to open a branch plant in Long Island City.

New Franklin to Sell for Less Than $1,000

The new Franklin 4-cylinder model to sell for $1,000 or less was shown to dealers at a luncheon at the Commodore hotel during show week. It is stated that production will get under way in the near future. The car will be manufactured by a new company and another plant ultimately will be erected for its production.

In many respects the chassis follows the line of construction used in the 6-cylinder car. With the exception of there being two less cylinders the engine of the small car is the same as the six. Cylinder dimensions are the same—3¼ by 4 in.—and parts are interchangeable with the six.

One departure from the big car is the use of semi-elliptic springs on the 4-cylinder. These are overslung on the rear axle and underslung on the front axle. The frame is of laminated wood construction, carrying at each corner suitable brackets for mounting springs. The wheelbase is 102 in. Wood wheels are fitted, carrying 30 by 3½ in. Goodyear cord tires.

The rear springs have been mounted very close to the wheels and this has made possible the use of a light rear axle. The service brake is on the transmission and the emergency on the rear wheels. The latter are operated by a single cable. The propeller shaft carries two fabric universal joints. Steering is by worm and wheel, operating the tie rod by a transverse drag link.

The engine, which is cooled by a blower fan mounted on the front end of the camshaft, is mounted in an accessible way and is itself accessible. An unusual feature in connection with the carburetion system is the carrying of all the exhaust gases through an aluminum jacket surrounding a hot-spot on the intake manifold. By this layout the forward end of the exhaust pipe is brought around the front cylinder to the carbureter side and thereby escapes the ignition, starting and lighting units on the right side of the engine. The electrical equipment consists of the Atwater-Kent system.

Body Builders Elect Officers

At the annual convention of the Automobile Body Builders' Assn., held on Jan. 12, the following officers were elected: President, John Graham, president of Holbrook Co., Hudson, N. Y.; first vice president, H. H. Babcock, president H. H. Babcock Co., Watertown, N. Y.; second vice president, H. C. Urich, Fleetwood Metal Body Co., Fleetwood, Pa.; third vice president, H. H. Seaman, president Seaman Body Corp., Milwaukee; secretary-treasurer, F. D. Mitchell.

The first automobile body builders' exhibition, staged by the Automobile Body Builders' Assn. at the Twelfth Regiment Armory, New York, Jan. 9-14, was a pronounced success. Not being an exhibit of direct interest to the public, the attendance was small but select. Those who were present were just the ones the body builders wanted to meet and the lack of overcrowding and confusion gave them a splendid opportunity to get down to business with the vehicle manufacturers' representatives and the suppliers of body materials. Altogether there were 68 exhibits housed in the armory.

neys, 91 Mason street, representing interests whose identity will not be revealed until the enterprise reaches maturity.

Martin-Perry Co., Indianapolis, manufacturer of automobile bodies, with headquarters at York, Pa., has leased property at St. Louis, for the establishment of a new assembling and operating plant. The Indianapolis works will devote a large part of production to truck bodies for the Willys-Overland Co. Chapin Spahn is general manager.

American Commercial Car Co., Gratiot and French streets, Detroit, manufacturer of automobiles, has acquired a building at Knoxville, Tenn., for a branch plant. It will be enlarged to approximate 10,000 ft. of floor space A complete body manufacturing works will be installed.

Stahli Auto Body & Wagon Co., 6533 St. Clair avenue, Cleveland, manufacturer of automobile bodies, is having plans prepared for an addition, including improvements in present buildings, estimated to cost about $40,000.

The Southland Motor & Body Corp., Old Hickory, near Shelbyville, Tenn., will install new equipment at its plant. P. A. Wells is secretary and treasurer.

Kress Carriage Co., Concord street, Lawrence, Mass., manufacturer of automobile bodies, etc., will build a two-story addition, 45 x 93 ft.

S. A. E. to Meet at White Sulphur Springs

The Society of Automotive Engineers announces that its 1922 summer meeting will be held at White Sulphur Springs, W. Va. The dates selected are June 20-24, inclusive. Plans are being made for the customary sports, entertainment and technical programs which have made S. A. E. meetings such an attractive gathering in past years.

Selection of White Sulphur Springs was based on its unusually fine accommodations, excellent cuisine, complete sport facilities and charming scenic setting. A comparison of railroad fares to White Sulphur Springs from the principal automotive centers reveals the fact that it is about equally distant from all of them. Special hotel rates have been secured and practically all of the accommodations in the Greenbrier and White Hotels have been reserved for the use of the S. A. E. members. Reservation blanks and rates will be mailed shortly to the entire membership with advance details of the program.

The S. A. E. anticipates receiving a fare and half return trip concession from the railroads for the period of this meeting.

Adopt Standard Dry Cell Sizes

At a conference of manufacturers and users of dry cell batteries, called by the bureau of standards of the department of commerce, standards for cell sizes were agreed upon. Of the larger dry cells, 17 sizes were considered and 7 of these recommended as standard; 30 different sizes and kinds of flashlight batteries were considered and 8 of these adopted as standard; 2 sizes of batteries for use with radio apparatus were also recommended as standard for use with wireless outfits. Besides the elimination of useless sizes, specifications were adopted for the performance of dry cells which, it is believed, will assist in securing a more uniform product.

One Building Will House British Show

An announcement is made by the British Society of Motor Manufacturers, that negotiations are now practically completed whereby it will be possible to hold the London passenger car show this year in one building, thus obviating the dual show at Olympia and White City which has been objected to by exhibitors at the latter.

Improvement in Automotive Exports Since 1913

Automotive exports during the calendar year 1921 (December figures estimated on the basis of returns for the preceding five months) reflect the progress made since the pre-war year 1913.

The greatest increase over 1913, the last pre-war year, is shown in shipments of motor trucks—594 percent increase in number and 511 percent in total value. Passenger car exports increased by only 20 percent as regards total value, while shipments of parts increased 517 percent as regards value. Exports of bicycles and tricycles gained 113 percent. Motorcycles exported increased 166 percent in number and 324 percent in total value. Automobile engines decreased 9 percent as regards number and increased 0.4 percent as regards total value.

That the relatively higher prices of 1921 have not prevented a generous increase over 1913 exports is borne out by these figures, which show an increase of 58 percent in the total number of passenger cars, trucks, and motorcycles exported in 1921. The nearly equal unit values of 1913 and 1921 for almost all classes of motor vehicles, in spite of the higher prices in 1921, is probably accounted for by the shipment of larger numbers of lighter-grade vehicles that were selling in 1921 for the same price as the vehicle of much higher class sold for in 1913.

For example, although the price of all classes of cars was probably higher in 1921 than in 1913, the unit value of all passenger cars exported was approximately $1,000 in both years; that is, the sum which the importer could afford to pay for a car remained practically stationary, and with the higher prices of 1921 he had to take a different class of car. Unfortunately, there are at present no data available to substantiate this statement, but it seems the most logical interpretation of the figures.

Whatever the relation of price increases and increased exportation of lighter-grade cars, the fact remains that exports of automotive products, especially as regards motor trucks and parts, made a very much better showing in the 1921 year of general business depression than in the pre-war year of 1913; and the automotive manufacturer can, in spite of temporary slackness, look back upon a satisfactory development of his export business.

155 Models in 1922 Hand Book

One hundred and fivty-five models of motor cars are shown in the 1922 Hank Book of Automobiles which has just been issued by the National Automobile Chamber of Commerce, 366 Madison avenue, New York.

The book is a ready guide to the general appearance, price group and specifications of the principal models of automobiles and motor trucks being produced this year by the leading manufacturers in the United States who are members of the N. A. C. C. The gasoline passenger car section illustrates 155 models with 70 in the gasoline commercial department and 5 in the electric vehicle division. This Hand Book of the automobile industry in America has become a standard of reference among domestic and foreign dealers, export houses, American consuls, state secretaries, dealer associations and clubs. Copies may be obtained from the N. A. C. C., which makes a charge of 50 cents each to partially cover cost.

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. XLIII. No. 11 FEBRUARY, 1922 $2.00 Per Year Issued Monthly

Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City. Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 4.

The Automotive Manufacturer

The Hub ← A CONSOLIDATION OF → AUTOMOTIVE ENGINEERING

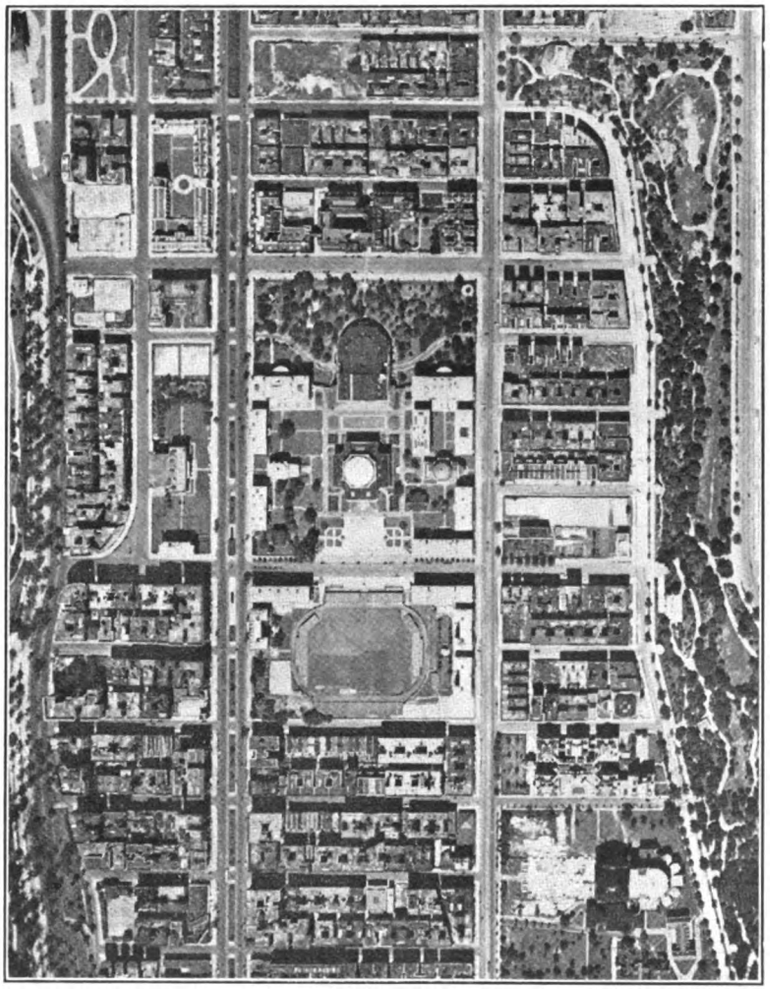
Vol. LXIII NEW YORK, MARCH, 1922 No. 12

Aerial Mapping and Photography to Save Enormous Sums

Besides the Great Economies in Municipal Work, the Widespread Use of the Aerial Camera Opens Up New and Wonderful Prospects for Airplanes

WHAT may easily turn out to be one of the biggest things ever developed for airplane and camera manufacturers, as well as municipal officials, surveyors, civil engineers, city planners, and many others, is the aerial camera. This appears to have been perfected, if one may judge from the recent performance of mapping the whole of New York City in the space of 69 minutes, or slightly over an hour. This map, when fitted together measured more than 8 ft. long by 20 in. wide, and consisted of a series of small photographs fitted together. The completed mosaic photo-map showed more than 32 square miles of the metropolis, every street, building, vehicle and persons just as one would see it from a position high overhead.

The camera used for this special map is the result of three years of inventive work on the part of S. M. Fairchild, head of the Fairchild Aerial Camera Corp., New York. Inaccuracy has been the chief difficulty with various kinds of apparatus employed heretofore. Many technical problems were overcome by the Fairchild inventions which so improved the mechanism and actual work of this new camera that the results were better than 99 percent accurate — more than sufficient for all practical purposes, according to municipal officials and engineers and those of large corporations who see in this development limitless possibilities for saving time and money in many branches of their work.



(c) F.A.C. Corp.

Fig. 1. Section of the New York mosaic map, showing the Morningside Heights district. The white circle is Columbia University Library. Various well-known buildings and places will be noted by those familiar with the metropolis, such as Grant's Tomb at the extreme upper lefthand corner.

The New York photograph is a vertical one; that is, it was taken from an airplane flying directly overhead, and is known technically as a mosaic; or aerial map. Using a film similar to the ordinary camera, though larger, and regulating its exposure by means of an

electric timing device gauged to the relative speed of the airplane from which the camera was operated, Fairchild succeeded in removing the hundred and one difficulties which have delayed commercial progress in this kind of mapping.

Plotting the city into rectangular sections of a scale so that each section could be photographed individually from the plane right over its exact center, the entire city from the Battery to Van Cortlandt Park was divided into 100 parts. Each of them was photographed. The hundred photographs were taken in a single flight of 69 minutes. As the plane passed over the center of each rectangular section there was an automatic click of the camera, and the film automatically rolled into position for another exposure. When all had been "snapped" the 100 photographs covered the total area of approximately 32 square miles. They were then fitted together and mounted on cardboard—and there lay New York, with everything out of doors plainly visible and accurate in size and location.

(c) F.A.C. Corp.

Fig. 2. Diagrammatic plan of part of the New York area mapped, showing how this was accomplished in such a short time. Refer to Fig. 3.

All the details of a great city were visible at a glance, as Fig. 1 shows.

When shown to city officials, they were amazed. "Why, this seems to be the only method to secure first-hand information about the city; it is the quickest and least expensive I have ever heard of," said a city engineer.

At police headquarters, an inspector said, "If I had had an aerial survey of my precinct, I could have sat at my desk and determined the location and details of every roof exit, scuttle hole and skylight, had all that information right in front of me. It would have been a great help to us in directing a raid or surrounding a burglar."

The commissioner of public works said that he had intended motoring out to inspect two proposed operations but that with the map on his desk he could attend to it there in a few moments. A noted city planner believes that in the future the aerial map will be used in all city planning operations as it will enable them to plot the most direct routes, locate obstacles, determine the number of overheads and short cuts, and lead traffic up through the city and out into the suburbs. He said.

"A relief map in the study of any territory looking to its best development would be of the greatest value, but that could be made only after the collection of accurate information and as the result of field surveys. If then, without equipping survey parties and spending weeks and months laboriously collecting information, which is later to be used in these relief maps and models, we can, in as many days, obtain accurate information from an aerial photograph, or mosiac, it is quite evident that a great advance has been made in planning for the future development not only of cities but also of surburban and rurai districts." At the office of the borough president, it is planned to use the aerial camera to determine, through calculating distances by interval exposures, just how far groups of traffic can proceed for a given period of time with the least interference.

The possibilities and practical value of aerial maps and photographs are limitless, say experts, who point out that since they came into use during the war, thousands of ways have been discovered for making them distinctly important, and relatively inexpensive, in all commercial and industrial fields.

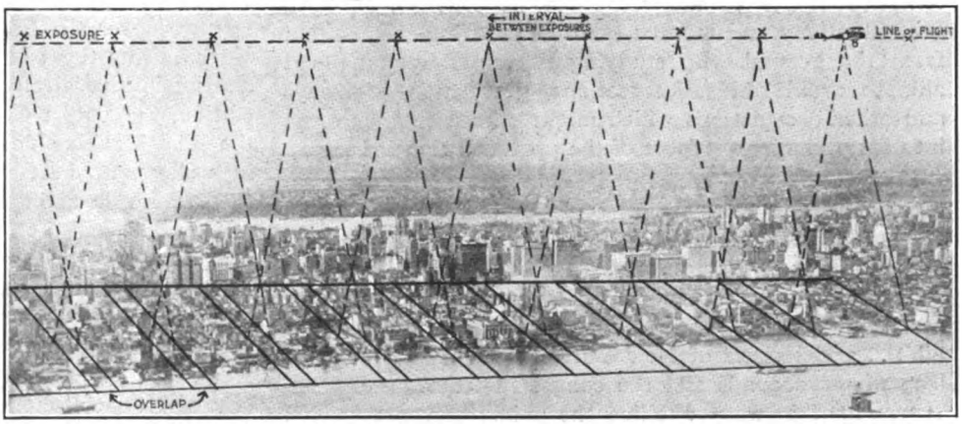
Like many notable inventions, applied photography from the air is accredited to accident. It appears that a private soldier, in the early days of the war, secured a ride in a battleplane flying over the front. Against the rules he took along his little camera and snapped whatever he saw below that interested him On landing his films were confiscated by officers, who to their astonishment found that the negatives provided them with accurate and detailed information which even the trained eyes of the observers had missed. It was a permanent record that could be studied and interpreted by many eyes, many minds, quickly, hastily, or at leisure, whenever opportunity arose or occasion demanded. Continued expansion of the idea has resulted in cameras being made that will take detailed photographs from an altitude of 35,000 ft., though for special commercial work 10,000 ft. is considered most economical. But 5,000 ft. altitude is most efficient for portraying everything below most clearly. Aerial photographs taken from an angle are termed oblique views and often are effective from the pictorial viewpoint. To the person studying the oblique photograph, it is the same as occupying a grandstand seat in the sky, with the panorama laid out before him and receding in the distance.

The aerial map, or mosaic, or vertical view, as it is variously known, is a different thing. It requires an equality of detail throughout and over large areas, while the oblique loses the detail in the background. The details diminish with great rapidity and, due to the angle at which the picture is taken, will not permit of overlapping or joining

consecutive areas. On the other hand the angles of the vertical picture are symmetrical and permit the overlapping of a large number of photographs, thereby covering great areas and maintaining equality in detail.

To secure this accuracy, Fairchild developed what is known as the between-the-lens shutter which actually saves the brief instant which other shutters spend traversing the plate during the exposure. This instant would matter little in ordinary photography but in mapping, or making vertical shots, the speed of the airplane would cause a distortion in the map. The focal plane shutter has been used in the past and serves its purpose for oblique views which do not require accuracy. The between-the-lens shutter exposes the entire plate in 1/150th second and it can be seen that the plane has traveled no distance in that instant. The whole plate is exposed at once, instantly, and from the same position, while the focal plane shutter, though its speed may be rated 1/150th second, actually exposes part of the plate only in this time. That part or portion exposed is only the actual width of the slit in the shutter curtain; but this distance must be multiplied by the actual length of the plate—and in reality the time taken for the exposure is reduced to approximately 1/10 second during which time the plane has traveled approximately 16 ft. All of which is to say that the picture is taken from two viewpoints 16 ft. apart at its ends. This causes distortion which makes accurate joining of pictures extremely difficult and oftentimes impossible.

The new camera is equipped with the automatic interval device for timing exposures according to the speed of the airplane and the automatic spacing device for conserving the film, or in other words, getting more exposures on one roll of film.



(c) F.A.C. Corp.

Fig. 3. Cross-section diagram, which in connection with Fig. 2 shows how the aerial mapping is accomplished. All Manhattan was done in an hour.

Actual uses to which the new Fairchild camera has already been put would seem to illustrate the soundness and practicability of the inventor's conclusions. Take the aerial photographs of the Carpentier-Dempsey fight in Jersey City for example. Fairchild photographers experimenting with the camera remained at an altitude of 2,000 ft., thereby obeying the law. The weather was anything but propitious for photography. It rained at intervals, mist shrouded the earth and blotted out all details to the human eye. But the eye of the camera nearly a half mile above the great arena caught the complete details, the rain, weak light, haze and heavy mist.

The aerial photographers operating the Fairchild camera photographed the preliminaries of the championship fight, took them back to Manhattan in their flying boat, landed, hurried into a newspaper office where the films were developed and the prints were actually mailed to all newspapers throughout the country before the bout had been decided. After delivering their negatives, the camera men again flew back over the arena in Jersey City and snapped the big fight from the air, remaining until the crowd started to leave. Again they crossed the Hudson river and taking the plates to the newspaper office succeeded in developing them into prints before the arrival of the photographers who had covered the fight from the ringside. It was an illustration of the speed of the airplane and the practical and speedy efficiency of the Fairchild camera and auxiliary apparatus.

Then there is the case of the old frigate, Granite State, which burned to the water and sank at her dock at 98th street and North river. The origin of the fire was a mystery until officials scanning the aerial photographs made of the fire and immediately preceding it, discovered the presence of foreign substance floating on the surface of the water along that part of the waterfront. It proved to be oil. An investigation resulted in tracing the oil to a broken pipe line on the river bottom. No factory or plant using the waterways for illegal sewerage purposes can avoid the eye of the aerial camera. It has demonstrated its efficiency in scores of cases; and has been accepted by the courts as material and relevent evidence.

There are recorded cases where companies have been able to influence the award of more than the customary amount of insurance after a fire, flood or other property damage, chiefly because they presented aerial photographs proving the extent of the damage sustained, back of the fire lines as well as the actual damage done to buildings. It happened in the case of the Erie railroad pier fire in Jersey City. The piers burned. The damage to them was easily shown and proved by the railroad company. But when they made aerial views showing the paralyzed state of traffic in their yards and on all their trackage, it was not difficult to convince the insurance adjusters that material damage amounted to more than the burning of the piers.

The owner of a famous nursery at Amawalk-on-the-Hudson was able to secure in one photograph, a complete portrayal of all the special and foliage, actual number of the 350,000 trees and their height. It saved sending an agent on a tour of the premises to sell prospective purchasers. All the selling, practically, is now accomplished in the office hundreds of yards from the rolling acres across which the staff formally trudged many weary miles daily. They now sell in the front office, or by canvassing with their photographic exhibits or through the medium of catalogues containing aerial views artistically arranged and printed.

Arthur S. Tuttle, chief engineer for the New York board of estimate and apportionment, and credited with being one of the first city officials in the country to use aerial

surveys for a practical purpose, found that their value is limitless both from the time-saving and economical points of view. He ordered a mosiac map from Fairchild in connection with the Narrows tunnel project and marginal railway plan for the development of the New York port.

The survey made from the air covered the proposed marginal railway territory, freight classifying yards and belt-line road, connecting all the railroads terminating in New York. His principal objects were to put the plan most comprehensively before the railroad and other executives in the quickest possible period of time. One of the most interesting facts brought out was that the aerial map revealed the location of waterfront property on Staten Island, along Arthur Kill, close to New York, yet undeveloped, while on the opposite shore of Arthur Kill, in Jersey, the aerial view brought out distinctly the active industrial conditions there made possible by excellent rail facilities.

In showing his aerial map before the railway executives and engineers, Mr. Tuttle was able to demonstrate the feasibility of his railway plans in tying up transport with the new Staten Island piers. Also, he was able to make tentative charts of the routes to be taken, without a ground survey and months spent in securing information from the ground. By studying the aerial map he was able to avoid residential sections, graveyards, highways and other obstructions which might otherwise have crept into his preliminary report of the proposed right of way.

Hotels have used aerial photographs in their advertisements, showing patrons how centrally located they are in respect to other districts, such as the railroads, theatrical and shopping centers. Ports, Chamber of Commerce and surburban towns have benefited to remarkable extent by aerial advertising. The American Red Cross recently exhibited aerial views of New York's east side showing the lack of playgrounds and the congested tenement district It was another way of telling the public how the foreign population lives.

This accurate portrayal of built-up sections and the wasted or uninhabited districts are matters for industrial and economic experts to consider. Not long ago a committee was appointed to ferret out the reasons why one side of a small stream in New York state was built up with factories and homes while the other side had remained barren. It seemed a simple assignment, yet none of the reasons advanced was proof against argument, until an aerial map of the entire territory was made. There it showed conclusively the trend of building and occupation had followed the railroad on that side of the stream.

By far one of the main considerations of aerial photography is its saving in time and money. Securing a clear detailed vision, permanently, of areas under development, or plots damaged by fire, flood or storm, taking out timber or protecting that timber from forest fires, swamp drainage, excavating or municipal improvement, is economical.

The Fairchild camera man left Curtiss field, at Garden City, Long Island, N. Y., in a Curtiss standard plane. Over Port Washington he photographed the entire village; thence to Mamaroneck, N. Y., where Miss Merrill's School for Girls was photographed; over White Plains, completely photographed, also Gedney Farms. On to North White Plains where a view was made of the town; then to Kensico Dam, so large that ground photographers cannot get a complete view of it. The aerial picture gave it all including the surrounding hills and watersheds. On to Croton Dam, he duplicated the work there. Over to Valeria Homes where photos were made for engineering data and advertising displays, showing the plans for new buildings and building operations already under way; there also were taken views of the infested mosquito swamps and drainage system, giving in detail the enormous amount of work done, which incidentally gave a reason for the expenditure of the appropriations. The plane then went on to Peekskill where the Fleishman Yeast plant was taken; on down the Hudson Valley where a school was photographed, also John D. Rockefeller's estate, then the Sleepy Hollow golf course, Spuyten Duyvel, the United Electric Light & Power Co.'s plant, the Bronx Concourse and finally the new electric plant on 133rd street in the Bronx. In all 84 aerial photographs were taken during the flight—80 percent of which were perfect and sold.

On another occasion a camera man was sent out of Port Washington in a plane and he made photographs of the Consolidated Gas Co.'s plant at Astoria, L. I., Newton Creek Realty Corp., showing details of property, its location relative to the Grand Central Station, the 59th street bridge, and the broad highway leading through the property and over the East river right into the heart of New York. From there he went over the Austin Nichols plant and made several close-up views for a special newspaper edition, the Drake Cake factory, the Baker Shoe factory, the Bliss Machine Tool Co., which wanted their five buildings shown to best advantage for calendar purposes, the S. S. Paris departing from New York with Premier Briand aboard, and then over the bay to Port Newark which was photographed from high altitudes, thence to the William Shupe Lumber Co., which used the photographs to announce their removal from Orange to Newark on the Passaic river, and incidently to show their proximity to New York City and the heart of Newark; thence over the city of Newark where clear views of traffic, main streets, and residential sections were made (and later delivered), still on to the Submarine Boat Corp., showing New York and its harbor in the background, then down to the F. M. Taintor factory where paris white is made.

The views when completed actually bore out the assertion of H. E. Bessom, editor of the House and Trade Journal, who said, "The ground view does not do justice, a wash drawing is usually unconvincing and is discounted; but that the aerial view pushes back the horizon, and one gets a different perspective with two sides and the top of all buildings."

It is the forethought back of aerial photography together with light and simple equipment made up in compact units that has brought about the present successful development. With this kind of equipment the operator needs only to link up his aerial view with landmarks and other things that make the picture interesting—just as one would do in any successful photographic venture. The factory which recently purchased views to reproduce on its shipping tags was following the line of least resistance in giving every person who saw the tag a conception of the institution shipping the goods.

This idea is being developed into another branch of the business. It has led to stocking prints, or to explain, saving prints of growing sections of city or country. By continuously taking photographs, say at regular intervals,

(Continued on Page 28)

Modern Upholstering for Fine Motor Cars--V

An English Expert Discusses the Most Comfortable Type, Pleated Button Work in a Y Pattern Advocated, Hand Work Less Expensive than Machine

STRANGE as it may seem, most of the trimming in vogue in recent years on motor cars has been brought out for appearance sake rather than for comfort. The double spring cushion and consequent extra depth of cushions is a notable exception, but besides this upholstery of various types has been widely used which was selected not for its comfort but for its appearance and in spite of its lack of comfort.

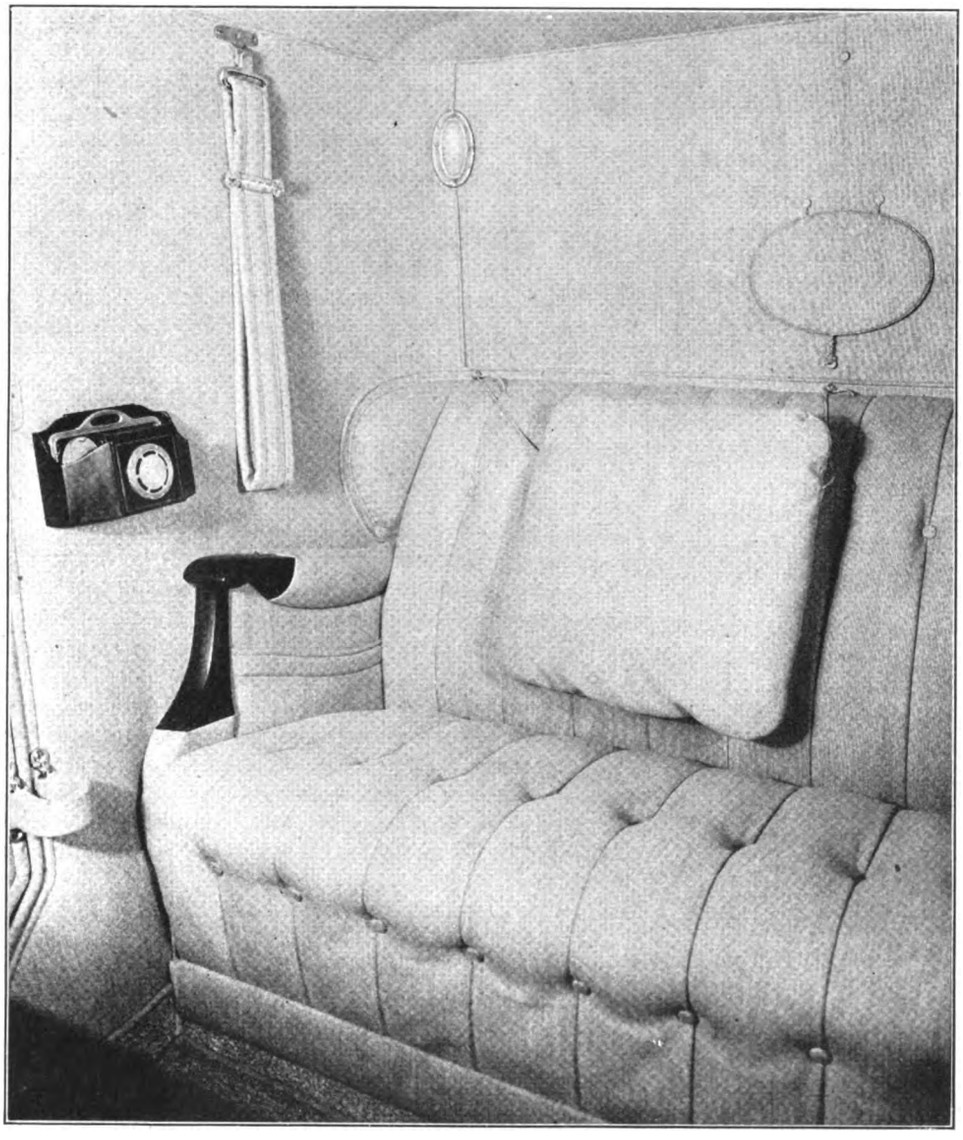


Fig. 16. Interior of Sunbeam (English) town car, upholstered in worsted dark gray cloth with pin stripe. Note straight-piped upholstery with minimum of button work. Upholstery by Boyriven.

Now comes an Englishman, W. D. Bridgwood, writing in Cooper's Vehicle Journal (London), who says that the pleated button work upholstery which is now slowly but surely going out of vogue in this country, is not alone the most comfortable form, but along the line of recent British developments can be put up by hand cheaper than the present system using tufting machines.

Among other things he says that of recent years we have seen many types of motor car upholstery, or trimming as coachbuilders prefer to call it, and no doubt many interested persons are disturbed as to which type is the most comfortable.

Different motor manufacturers have much to say in praise of the particular style which they are fitting to their bodies at the time. But one finds, however, after a careful survey of the various productions extending over a number of years that they alternate from one style to another, doubtless in search of superior appearance or greater comfort.

It is said that a Windsor chair with its leanback is far more comfortable than many standard types of motor body upholstery. This, in many cases, may be perfectly true but with an equal amount of leanback a motor body must in addition be well padded and sprung, and have plenty of freedom of movement.

Modern Tendency to Plain Flutes

Of late years there has been a tendency towards the plain fluted styles of upholstery, probably due to the many American cars fitted in this way, and also because it is so much cheaper, and easier to produce on the quantity basis than buttonwork upholstery with "years behind the time methods" of manufacture.

With the former type of trimmings as fitted to cheap cars one experiences an aching void around the back necessitating numerous moves into various postions in search of a "comfy" spot amidst uncomfortable upholstery. To obtain a real comfortable sitting position it is essential that the shoulders should be allowed to sink into the squab, with the front of the cushion fitting snugly under the knees. This can only be obtained when a squab is well cut, and the necessary allowances made in each pleat to allow the leather or cloth to give along with the springs. Much depends also upon the manner in which the canvas backing is fixed to the body. When canvas is pulled tightly from top to bottom, and corner, as is usual with plain fluted types of upholstery, it is almost impossible for the padding to sink back sufficiently for any degree of comfort unless something gives way.

Theoretically, the pleated buttoned upholstery, with proper allowances, is the most comfortable, and the amount of the comfort given by this type on a long journey is perhaps the most convincing answer to the question suggested in the title of this article.

Plain Pleating for Fine Cars Only

Few cheap British or American cars are fitted with pleated buttonwork upholstery today, whereas the majority of our most expensive cars are invariably fitted in this manner. Our leading coachbuilders "plump" for buttonwork almost without exception.

The motor manufacturer is more than content when he has satisfied himself that his engine or gear-box is as silent as can be expected for the price.

Whether the people who have the "say" in these matters ever had a long ride in cars of their own manufacture is an open question. It's a case of "If it sells why worry."

A step would be taken in the right direction if our designers of standard coachwork, and engineers, put their heads together with a view to producing chassis and bodywork which will allow for deeper upholstery and seating. If one cannot afford expensive bodywork and upholstery one must sit bolt upright and be content, as very little consideration is given to seating comfort on standard bodywork today. The manufacturer may reply that a customer must not expect luxurious upholstery in a cheap or moderately priced car, because it cannot be done at the price. But if one cannot have luxurious trimmings, it has been made possible to have comfort at the price.

By a system invented just too late for last year's show, it is possible for a squab or cushion to be cut, modelled to shape, and fixed into a body at half the cost of the present system with tufting machines, and a quarter the cost of the prehistoric method of attaching leather to canvas by buttons fixed by hand.

From the accompanying illustrations (Editor's Note: It was impossible to reproduce these. They showed a front view of the double Y shaped seams, and a back view with the stitching and button fixing) it will be seen that the leather or cloth is stitched from the back on to the canvas. The squabs are formed in this manner with the necessary allowances in each pleat, and it will be noticed that any skill, such as is required with the modeling or stuffing of the ordinary types, is eliminated by the formed pleats.

Other Advantages

Another advantage of this system is that as there is no strain upon the buttons there is little likelihood of them becoming detached and the padding displaced, a common fault with usual types.

This is not merely a theoretical proposition, but a sound practical job, which has undergone most severe tests over the roughest of roads for long periods without the slightest sign of displacement of the padding or buttons.

The makers of one of the best known new car propositions and remarkable value for money, fitted this type of upholstery to part of their output, and found it all a pleated button job should be, indeed, this system would have been adopted as standard by a number of firms if it had been ready for the show of last year.

There are other systems which have points to commend them, but after costing the job, one finds there is ample room for improvement on the various systems of cutting and making up.

Very few trimmers cut on a simple geometrical system, preferring the style adopted by their fathers and grandfathers. Some men suck a thick pencil for hours while cutting, as if it were a sweetmeat, others carry wherever they go what they are pleased to call their "sweeps." Let's hope our ex-soldiers undergoing instruction are not wasting their time probing the mysteries of tasty pencils and "sweeps."

The only drawback to button work on open cars, if it can be "dubbed" such, is that it is not so easily cleaned as the plainer types, but one is more than compensated by the extra comfort obtained, apart from the more luxurious appearance.

Cost, as an excuse when comfort is being sacrificed, should be wiped right off the program, and an investigation in order to ascertain what is wrong with the present methods in use. Let manufacturers remember that, although a man may be able to afford only a cheap car, he desires comfort and also takes long journeys.

Use of Fabrics Makes a Difference

While Mr. Bridgwood is logical in most of his arguments, this form of upholstery lends itself only fairly well to some of the finer fabrics now being used so liberally. When the fabric is considered, and nowadays it must be considered very frequently, the situation is radically changed. The accompanying illustration, Fig. 16, shows a very expensive English motor car, upholstered in one of the season's popular fabrics in a modification of the type just described. As the illustration points out quite plainly, the straight pleats with button work on a very modest basis, that is with very few buttons, is extremely attractive, and on this particular Sunbeam town car was remarkably comfortable.

Bearing in mind how important the fabrics are, as distinguished from the leather and imitation leather trimming materials, it will be interesting to note what the woven fabric people say about the various woolens, corded fabrics and others. In a recent interview with the American representative of a prominent French firm much stress was laid upon the fact that the pure woolens with light hair line stripes are the most popular right now. These cloths, he continued, run to almost all color combinations. The newer lines are more sombre in tone than the early summer patterns, giving, when made up, an effect of rich and quiet elegance to a car interior. The dark blues, clarets and lakes have to some extent made way for the more delicate buffs, fawns and grays—marking a very decided change in American taste. The most popular grays are those embodying a tone of blue, green or brown, and most of these called for are shot with a white striping.

Bedford Cords Popular

Another fabric which is becoming popular this season is the bedford cord. We manufacture this in England and import it direct from our London office. This is practically everlasting and in the lighter shades of buff and gray, as well as dark green and brown, it is beginning to be used quite extensively, on account of this quality of durability. Beford cord produces a remarkably luxurious interior.

Tapestries are generally looked upon nowadays as being out of date. The large flowered patterns in many heavy colors are probably gone forever in highgrade work. But we find on the continent a revival of this delicate and stylish upholstery. The new French silk tapestries are

done in one color, or two shades of one color artistically blended, and in simple conventional pattern. The effect is new and very rich.

We have just inaugurated a distinctly new line of upholstery material, known as our worsted cloths, which we have just received in various mixtures, with the following predominating colors: blue, green, maroon and brown. This cloth is especially suited for coupe and sedan bodies. As we all know, these types of automobiles are used extensively in suburban life, and are subject to great wear and tear. This cloth is made of pure worsted of very close weave, and is practically indestructible.

In the new styles of trimming we, for our part, are selling a considerable amount of coach lace. In the case of a notably fine car, it was noted that the large rear cushion is halved and the lower part bound in broad lace of simple design. The door is framed also with broad lace. The use of the broad lace as a frieze at the top of the car is a new idea of decoration. This interior also shows the broad lace adapted as a window regulator. This is a foreign make of car, and perhaps this latter would be considered going too far in that direction over here. The public is demanding more and more every day coach lace trimming to get away from the usual cold and severe appearance of interiors. One very distinguished designer not long ago characterized many of them as "tomb-like." You will also take note of the real horn pull-to and lever-lock handles These are also carried in stock in a novelty form—of real tortoise-shell, mother-of-pearl, ivory and black horn.

Another fine car shows a different treatment of a sedan model. The very comfortable seats are built slanting inward, thus insuring both comfort and added safety. In this, the seat is divided by a low arm to prevent the second passenger from jolting against the driver on sharp turns. Also the center of the rear cushion is curved to fit the back. Between the seats there is a long, three-cornered flap terminating in a convenient handle. This covers a pocket holding all the small necessities of the trip. In this particular interior broad, seaming and pasting lace is used throughout, and yet, while the interior shows great simplicity, there is much more warmth and hominess of feeling.

Book Review

Aluminum, by Lt.-Col. C. Grard, translated from the French by C. M. Phillips and W. L. Phillips. 184 pp., 87 charts and 24 plates mostly reproductions of microphotographs. 5¾ by 8¾ in., blue boards. $5.00. D. Van Nostrand Co., New York.

This able work along the technical side of aluminum and its alloys by a prominent French metallurgist, will be a welcome addition to the scant literature on the subject of this light-weight metal. The author takes up the properties, thermal treatment and industrial applications of the pure metal in its various forms, and its alloys. In his method of treatment he divides the whole subject into these three major parts: first, light alloys of low strength; second, light alloys of great strength, both of these being mainly aluminum; third, heavy alloys of great strength. The latter are mainly copper, what are generally known (although erroneously) as the aluminum bronzes, but these the author treats from an aluminum standpoint.

The book is written in a very concise, almost abrupt style, but is practically all facts, with few author's deductions from these. The data, which are simple, combined with this concise style, will serve to make the book more valuable to the busy worker in this field.

Automobile Repairman's Helper, by S. T. Williams and J. Howard Pile. Two vols. Vol. I, 525 pp., freely illustrated with line drawings. Vol II, 545 pp., similarly illustrated. 6¾ by 4¾ in., flexible red leather. Each volume $3.00. U. P. C. Book Co., Inc., New York.

This is a compilation into a handy book form for the repairman and shop worker of a series of hints and tips which have been appearing serially in Motor World for a number of years. Their accuracy and value having been proven by the test of time, these have been put in a very convenient form, and one which all workers on motors and trucks will welcome.

A good idea of the scope of this work and its very practical nature may be gained from the chapter headings of Vol. 1. This is divided into three parts: I. Repairman Practice, II Passenger Cars, and III Trucks. Chap. I takes up Laying Out the Building; II, System in the Repair-shop; III, Stationary Shop Equipment and Tools; IV, Belting and Pulleys; V, Building and Service car; VI, Making a Crank Offset; VII, Cylinder, Piston and Ring Work; VIII, Trouble in the Electric System; IX, Storing Batteries; X, Straightening Body Parts; XI, Bearings; XII, Speedometers; XIII, Dodge cars; XIV, Overland; XV, Chevrolet; XVI, Reo; XVII, Cadillac; XVIII, Studebaker; XIX, Oakland; XX, Hupmobile; XXI, Willys-Knight; XXII, Liberty; XXIII, Cole; XXIV, Chalmers; XXV, Autocar; XXVI, Republic; XXVII, Reo; XVIII, Garford; XXIX, Koehler, and XXX, Nash.

The second volume which is just off the press (volume 1 was issued in 1921) is along similar lines, and supplements Vol. 1 in an admirable manner, the two making a most complete and equally desirable repairman's printed aid.

Car Shipments 150 Percent Above Last Year

Carload shipments for automobiles at the beginning of 1922 showed a 150 percent gain over a year ago. Reports of sales conditions from all over the country show improvement.

Traffic counts by the U. S. Bureau of Public Roads show that 97.3 percent of the vehicles on the California highways are motor propelled. Motor trucks constitute 12.48 percent of the total traffic.

The value of automobiles produced in 1920 was $917,470,000. If the $450,000,000 in tires, the $184,000,000 paid for garage hire and wages, and the many millions spent on motor car accessories, are added, the automobile industry looms up with $1,500,000,000 turnover ahead of the steel and iron industry.

Turning Wine Into Fuel

South Africa has ten million gallons of surplus wine, and it is to be converted into motor fuel, for which purpose a substantial factory has been erected at Paarl at an initial cost of £60,000. The first output of the factory has been delivered. The still is capable of turning out 3,000 gallons a day. The South African Motor Fuel Supply Co., Ltd., is the name of the new concern.

Fig. 1. A lone truck opens up the Frederick Pike, Maryland.

Fig. 2. They push it off in Pennsylvania.

Wide Awake States Are Keeping Highways Clear for Use

Snow and Ice Removal in Winter, No Holes, Pockets or Thank-You Marms in Summer, Make Road Transportation Easier, Continuous and Economical

PRACTICALLY all of the states of the Union have found that the volume of motor traffic the year round is now so great as to necessitate continuous road work keeping the highways clear so these vehicles may proceed without delay. It is estimated that the number of motor trucks now in use exceeds a million by a considerable figure, while the total of passenger cars is rapidly approaching the ten million mark. With this number of automotive vehicles, one-third of which is in the hands of farmers or people of strictly rural communities where distances are great, it is small wonder that a very large number of them is on the roads all the time, regardless of the season or weather.

Time was when road work of all kinds was confined to giving the surfaces the "once over" early in the spring, and possibly an additional casual inspection with some work, in the fall before cold weather set in. It has been found now that motor vehicles have so altered the situation that keeping the roads ready for use is an all-year job, not confined to any one season or month.

What was formerly the vacation season, that is winter when no road work at all was done, is now the busiest time of all because the removal of snow and ice is more difficult than any other form of road work. Organized crews, equipped with snow removal apparatus, are on the job in many states to keep the highways open throughout the winter months. Snow plows, road machines, blade graders, trucks and road drags have been distributed by a number of state highway departments so that when Old King Winter starts his annual onslaught an effective means of combating his snowdrift attack will be at hand.

Motor vehicle transportation is just as necessary in winter as it is in summer. By making the highways passable during the winter months the economies effected will more than offset the expense of snow removal. By utilizing

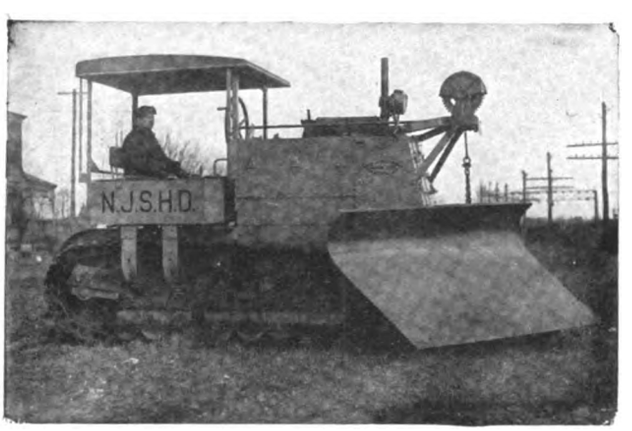


Fig. 3. Tractors are used in New Jersey.

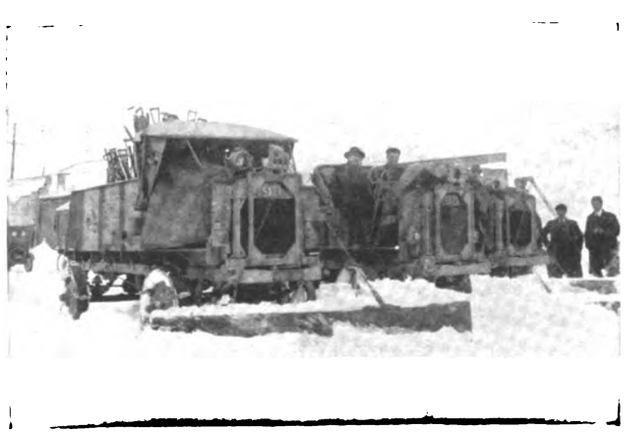


Fig. 4. Trucks are a part of the New Jersey equipment.

Fig. 5. A truck and road scraper does the job in Wayne County, Michigan.

Fig. 6. A novel sweeper for light New Jersey snows.

Fig. 7. Road building machinery is given a winter job in Wisconsin.

idle road machinery and idle labor, roads can be kept open which otherwise would be useless because of snowdrifts.

Some of the forms of motor vehicles used for cold-weather roads are shown in the illustrations herewith, the eight devoted to snow removal being reproduced through the kindness of the Editor, Concrete Highway Magazine, published by the Portland Cement Association. However, as any road man will tell, snow removal is but a small part of the total of road work, and to conduct the other work economically and efficiently, many special motor vehicles have been constructed and two of these are shown.

The truck at the left is a new type of truck body which has been designed and constructed by the New York State Commission of Highways on a Packard chassis. This form of body will be used in all repair and construction work in the state building and maintenance of roads.

An adjustable chute which may be used for dumping rock, gravel or sand at required spots along the sides of the road with the minimum of shoveling operations is one of the interesting features of this body. The chute is inserted into an opening provided in either side of the end gate. A sliding door operated by a hand lever which is situated below the center of the end gate provides the opening necessary for admission of the chute. After removing the chute the end gate may be raised and rock dumped into the center part of the road if desired.

The truck body is 12 ft. in length and 6 ft. in width. An hydraulic hoist mounting makes it possible to use the truck as an end or side dump. Side sections may be removed entirely and the platform body may be used for transporting asphalt or other materials in barrels. The side sections may also be removed singly so that rock or sand may be dumped to the side in various sized piles where it may be needed for emergency repairs.

The other road building truck, shown at the right, is of an entirely different type. This was constructed on the assumption that the handling of road-making materials requires an extremely short wheelbase so as to give short, quick turning ability, but that this would only be useful if combined with adequate power, and a proper amount of transmitting this to the wheels.

As can be seen from the illustration, the road builder truck, just placed on the market by the Four Wheel Drive Auto Co. has the extremely short wheelbase necessary, while the four-wheel drive feature, peculiar to all vehicles

(Continued on Page 29)

Fig. 8. The Dover-Smyrna Road in Delaware is made ready for traffic.

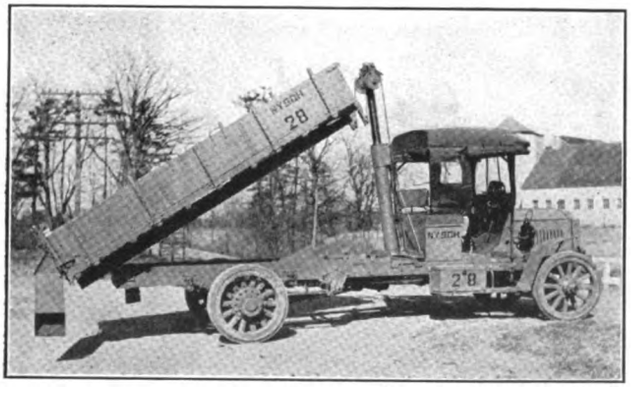


Fig. 9. Side view of new New York state road truck, showing end chute.

Fig. 10. New western road truck with short wheelbase and dumping body.

Standradizing Malleable Iron Improves Product

BY R. S. GILDART

Automotive Manufacturers Will Be Interested in the Progress Made in Increasing Strength and Reliability of Malleable Castings Through Standardizing Foundry Methods

WHILE the number of malleable castings used in motor trucks is small, and in car construction almost negligible, there is no real reason why this should be true. In recent years, as will be shown, through standardization of foundry methods and procedure, great improvements have been made in the product, so that greatly increased strength is available. This combined with its many natural advantages over cast iron, and the fact that it costs about the same as cast iron and much less than steel, should make for a wider adoption of this metal in automotive work.

How many of us are aware of the remarkable improvements that have recently been made in the physical properties of malleable castings—advances which help to explain the increasing use of malleable parts by automobile, truck, tractor and farm implement manufacturers? How many of us know that in the case of 60 representative malleable iron foundries the average ultimate tensile strength and elongation of their product as measured by standard test bars was shown to be 53,000 lb. per sq. in. and 15.8 percent respectively?

These values are further emphasized when we remember that less than 25 years ago the average tensile strength of malleable castings was about 35,000 lb. per sq. in. and the elongation was about 2 percent in 2 in. Thus at that time malleable castings were but little superior to gray iron which has a tensile strength of about 20,000 lb. and practically no ductility.

Such gains in the strength and toughness of malleable iron have come very largely from the efforts of the American Malleable Castings Association. During the past four years, this organization has been conducting extensive research work and helping malleable foundries eliminate all rule-of-thumb methods. It has succeeded in placing each step in the production of malleables on a scientific, standardized basis, and so aided in the production of unfailing good commercial castings.

Reference to the accompanying chart showing average ultimate tensile strength and elongation for the product of the membership as a whole for 1918, 1919, 1920, and the first six months of 1921, indicates clearly how these two properties have increased during this interval. The average of both properties has always been well in excess of the A. S. T. M. standard requirements of 45,000 lb. per sq. in. tensile strength and 7½ percent elongation in 2 in. It is clear that this margin, when added to the factor of safety already included in the standard specifications, offers exceptional safeguards to the user of those malleable castings furnished by a majority of the members of the association.

A study of this chart will show that during the year 1918 there was recorded a gradual increase in both tensile strength and elongation, with a slight retrogression from July to October. During 1919 and the spring of 1920, both properties remained fairly constant averaging around 51,000 lb. tensile strength and 12 percent elongation. From April of 1920 to August of the same year, these properties increased to values never before reached, the tensile strength increasing very rapidly from 51,000 lb. to over 53,000 lb., when a slight depression set in extending to the month of November, since which time the increase has been rapid and regular with one slight interruption in tensile strength. It will be noted that the two curves run fairly parallel, rising and falling together, a characteristic of the product which is rather unusual for ferrous materials, the reverse normally being true.

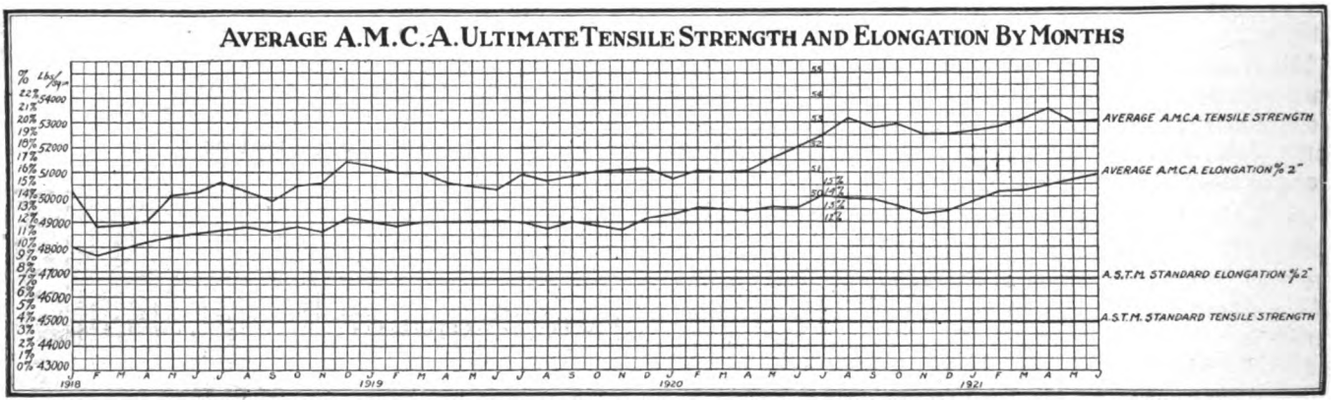


Chart showing average tensile strength of malleable castings as it progressed by months from Jan., 1918, to June, 1921.

The constancy in the average values of both properties maintained throughout 1919 and the spring of 1920, with little apparent improvement over a period of several months is readily accounted for by the fact that during that time 22 new plants were added to the list of test bar contributors. None of these had previously profited by the research work, and their submitted test bars in most cases had the effect of lowering the general average of the association until after such time as the effect of the new influence began to assert itself. The same effect was felt from August of 1920 to December, when four new contributors were added. No new contributors were added from April, 1920, to August of the same year, nor during the period from December of 1920 to June of 1921.

This fact, taken in conjunction with the improvement in quality of the new contributors through the assistance of the consulting engineer and his corps of visiting inspectors, had the effect of a steady and rapid increase in both physical properties. The slight retrogression in the average values of both properties marked by the dropping of the curves from August to November of 1920, is explained by the serious handicap experienced by the foundries in getting good pig iron and coal during that exceptional period of demand for all commodities.

The association has had much to do with the notable improvements achieved in the soundness, machining qualities, and finish of malleable castings. As a result of its recommendations chills have largely given way to the use of properly proportioned risers and feeders in order that any possible defects due to unequal cooling may be avoided. Hard scales have been eliminated by the careful selection of packing materials and better protection during the annealing process. And the sand blast has in many cases displaced the tumbling barrel in cleaning up the castings, to provide a cleaner surface and preserve the true shape of the part.

It is in the annealing process, which takes from 6 to 7 days, that malleable takes on its characteristic toughness or malleability. Here the white iron as it comes from the molds is packed in large iron containers and placed in annealing ovens. All brittleness is removed by bringing the castings up to a red heat and later permitting them to cool at the rate of about 10 degrees an hour. This careful heat treatment not only gives malleable iron its strength and ductility, but invariably frees it from all internal strains. In annealing, as in furnace operation, the preparation of molds, and in pouring, the association has been instrumental in developig closer control and finer precision. No detail has been overlooked in its efforts to insure the automotive industry reliable and entirely satisfactory malleable iron parts.

Castings that are produced in strict accordance with the high standards of the American Malleable Castings Association and subjected to searching tests and analyses under the direct supervision of the association's metallurgical experts, are known as "certified malleable castings." Member foundries whose test bars, taken daily from heats, regularly, measure up to the association's exacting specifications, and whose plant practice is such as to produce uniform material of high quality and integrity, are awarded a certificate of merit and permitted to term their product as "certified malleable."

This is one way in which malleable iron users are now assured castings of uniform and known performance qualities. "Certified malleable" parts have the high level strength, toughness and ease of machining together with the notable resistance to shock and corrosion that makes malleable iron so superior to common gray iron castings.

Although these castings cost no more than malleable iron of unknown quality, their superior strength and ability to withstand shock and wear enables the automotive manufacturer to use a lighter casting for a given purpose than would be possible with malleables of lesser integrity. Hence "certified malleable" is less expensive as well as a more dependable and better metal.

One thousand one hundred and sixteen miles of surfaced federal-aid roads were built in Texas in 1921, the largest record of any state. Minnesota was a close second with 1,066 miles.

Motor Vehicles in Germany

A short time ago, in a tabulation of the number of motor cars in the world, doubt was cast upon the available figures as to Germany. In this connection, actual accurate figures are now available, and show a surprisingly large total. Including tractors, since it is difficult to know exactly what is classified by the Germans as a tractor, and because their total is remarkably small anyhow, total number of motor vehicles accredited to Germony is 92,486.

A recent census of motor vehicle use in Germany discloses some interesting facts, such as the high ratio of street-cleaning machines to the total number of motor trucks, and the relatively small number of trucks compared with England. The figures which are of July 1, follow:

Motor trucks:	
By type—	
Internal combustion	29,536
Electric	858
Steam	30
Total	30,424
By capacity—	
1,000 kilograms and less	2,378
1,000 to 2,000 kilograms	3,796
2,000 to 3,000 kilograms	3,258
3,000 to 4,000 kilograms	7,737
4,000 kilograms and over	13,255
Motor fire apparatus	540
Street cleaning machines	264
Tractors:	
By type—	
Internal combustion	135
Electric	73
Steam	84
Total	292
By weight—	
5,000 kilograms and less	114
Over 5,000 kilograms	178
Cars and chars-a-bancs:	
By type—	
Internal combustion	60,135
Electric	763
Steam	68
Total	69,966
By capacity—	
Up to 8 seats, including driver	59,588
More than 8 seats	1,378

Theory of the Magneto Simplified

The Bureau of Standards has recently made some experiments on ignition for the National Advisory Committee for Aeronautics. Part of the results of these investigations have been published in a paper known as Report No. 123.

This paper describes a type of circuit which has been found useful for representing the action of the high-tension magneto. While this equivalent circuit is relatively simple, and consequently can be used as a basis for deriving definite mathematical formulas for induced voltages and similar quantities, it has been found experimentally to correspond quite closely in its performance with the highly complicated electrical circuit of an actual magneto. In the paper, formulas are given for the voltage induced in the secondary under various conditions of operation, and a number of numerical examples are worked out, showing the application of the equations to a variety of practical problems.

A copy of Report No. 123 may be obtained from National Advisory Committee for Aeronautics, Washington.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO.

Heptagon Building, 153 Waverly Place, New York City

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXIII MARCH, 1922 No. 12

A Possible Rival for Ford

AT LAST, it would appear that Ford is to have a real rival, one with the brains, financial ability and backing, and other qualities necessary to give Henry a real battle. In the Durant car, to be known as the Star, which was shown publicly at Washington and Boston recently, and which is to be priced at $348, or within a few dollars of the Ford, there is the basis of real competition, considered from several different standpoints.

From that of the manufacturer, Durant, leagued with Timken, Continental and other large parts makers, are substantial, have wide prestige, financial and physical resources, and other assets sufficient to cope with anyone.

From that of the buyer, the car offers a number of advantages over the Ford, not the least of which is its appearance of length, and through this, stability. Semi-elliptic springs all around, three-speed sliding gear transmission, disc clutch, conventional type of chassis frame. Timken roller bearings throughout, and vacuum fuel feed from rear fuel tank are notable points about it, which persons seeking a very low priced car will welcome.

It is claimed that 27,000 people went to view the car in its opening day showing at Washington, and that more than 1,000 orders were placed. At Boston it was claimed that 4,500 people saw it on Saturday afternoon and more than ten times that number in the full week. Orders were being placed at the rate of one a minute, applications for dealerships are being filed at the rate of 100 a day, and something like 1,700 orders have been received by mail at the New York office since the first announcement was made of the car.

All this spells real competition, and coupled with the admitted progress of the Gray car, which sells below $500, it would seem that 1922 is going to see home real sensations in the lowest priced field, a thing that has not happened for years, and which it was universally predicted would never happen.

New Sales Plan Radical Departure

DEALERS and agents are entirely eliminated in the rather sensational sales plan just put forward by the manufacturer of a modest priced car, hailing from Indianapolis. The idea appears to be to get as close to mail order merchandising as the product will permit. That is, the manufacturer will cut his price down to the absolute minimum, taking out the percentage generally allowed for the state and local distributors, and selling the cars through the medium of a corps of factory controlled salesmen cooperating with garages and service stations. The latter will be trained to give service for the car. The company's idea is to get the cars direct to the consumer without the usual high expense of the middleman.

This manufacturer has cut the car price from $1,295 to $875, taking off $420. It will be interesting to follow the progress of this scheme, as the manufacturer branches out beyond his home state, next year, and begins to attempt national distribution. If the method holds up under the wider distribution, the considerable saving, approximating 20 to 25 percent usually, to the car buyer, will force many makers to try the same scheme or a modification of it.

More General Use of Caution Plate Urged

At the quarterly meeting of the motor truck members of the National Automobile Chamber of Commerce in New York City, March 2, reports on sales were made which showed that the truck business was improving gradually. In Chicago truck sales had increased 25 percent. January production was 38 percent better than December.

At the general meeting of the truck members it was unanimously voted to adopt the recommendations of the Truck Standards Committee, as follows:

1. That the standard caution plate adopted by the Chamber in 1912 is more suitable for present requirements than any other form of plate.

2. That a more general use of this plate should be made and that the space provided for weights should be actually filled in.

3. That the manufacturer should recommend to the state motor vehicle commissioner that no license be issued for a motor vehicle unless weights are properly filled in on plate at time of application.

R. O. Patten, manager, truck sales division, Pierce-Arrow Motor Car Co., proposed that truck sales questions and answers be standardized to give the buying public a more rounded viewpoint of truck utility. It is expected that many of the members will follow out this suggestion.

Facts presented by F. W. Fenn, secretary, to the members of the Automobile Club of Canada at Montreal and to the ministers of highways and finance at Quebec resulted in the drawing up of a new bill to permit a maximum dead weight (vehicle and load combined) for any truck of 24,000 lb.

The N. A. C. C. will soon issue a booklet on driver civility. It was felt that a more general understanding of the courtesies of the road would bring about fewer accidents and impress upon motor truck drivers the importance of yielding the right of way to faster moving vehicles.

National Spring & Wire Co. has moved its general offices from Albion, Mich., to Detroit.

History and Development of Internal Combustion Motors--II

BY J. L. MORSE*

Tracing the Development Right Down to the Present, and Showing How Well the Engine Serves for Tractors, Railway Power Plants, Ships, Other Units

AS WE have seen in the first part of this article, appearing in the February issue, the early development of the engine was a very slow process, and consumed from inception to a practical, running engine which developed power in a usable amount, more than 200 years. Each of the early inventors and mechanics who worked on it added a little something, so that in the Otto engine which was marketed beginning in 1879, something useful and practical was available for the first time.

Slowly, even this power unit has been developed and perfected, and in the same slow way, more and more uses have been found for it. In this way, the internal combustion engine has been found practically perfect for the automobile, the airplane, the motor truck, the tractor, and other automotive units.

The gas tractor, which began its existence during the latter part of the nineties, and which consisted at that time of a stationary, single cylinder, gasoline engine mounted on a traction frame similar to the steam tractor of that time, had a slow and uncertain growth for several years. But during the last 5 or 6 years it has gone through a very rapid evolutionary growth resulting in a marked similarity of features in nearly all the different makes. The present type of tractor with few exceptions uses a four-cylinder motor modeled after the passenger car motor but being a little heavier and of slower maximum speed. Nearly all of the tractor engines are adapted to operate on kerosene which is the greatest departure from the passenger car type of motor.

Reversing Engines in Railroad Service

The crankshafts of practically all automobile, truck, tractor and stationary motors of the present time rotate in one direction only, and when necessary to reverse the motion of the driven machinery, some kind of a gear and clutch mechanism is necessary. This allows of the simplest construction of the valve and ignition gear on the motor. However the desirability of changing the direction of rotation of the crankshaft of the motor to better adapt it to railway and marine work, led engineers to investigate the possibility of a reversing gas engine. About 1905 the McKean Motor Car Co., Omaha, Neb., brought out a reversible six-cylinder motor to be used on passenger cars on the branch lines of the Union Pacific Ry. in Nebraska. By 1908 upwards of 25 of these cars were in operation.

The reversing feature consisted of a camshaft with two sets of cars, capable of being moved endwise, one set of cams being set for the forward motion and the other for the backward motion. The timing of the ignition was effected by means of a double-throw switch which was connected with timing points arranged to agree with the timing of the cams. To reverse the car it was only necessary to apply the brakes to bring the car to a stop, shift the cam lever and throw the ignitor switch to the opposite circuit. At least one of the six cylinders was filled with a compressed mixture, and far enough off the dead center to start the motor in the opposite direction. The engine was connected to the driving wheels by a silent chain drive. A clutch and gearing with two speeds was provided to aid the car in climbing grades.

The modern marine diesel engines are also built reversing both in this country and in Europe. As an example of the increasing growth of the powering of ships by the diesel and semi-diesel motors, it is interesting to note that at a meeting of the A. S. M. E., Dec. 19, 1918, in San Francisco, J. H. Hansen, president of the Scandia Pacific Oil Engine Co., in a paper devoted to the history and development of the diesel engine stated that at that time there were nearly 800 motor ships in operation of from 1,000 to 12,000 tons capacity. Some of the larger ones making 40- to 50-day continuous trips, covering over 10,000 miles and carrying 11,000 tons of cargo with a fuel consumption of 400 tons of fuel oil as compared to 1,500 tons of coal used by steamers of the same speed and carrying capacity, thereby not only saving 1,100 tons of fuel but making available 1,100 tons of cargo space not available in the steam vessel.

Economy of the Marine Diesel Engine

At the same meeting Bruce Lloyd, marine engineer for the concrete ship section of the Emergency Fleet Corporation, summarized the results of his observation of actual performance of a series of steam and motor-driven vessels by submitting the following figures for the average steel motor ship of 3,500 tons and the steel steamer of 5,000 tons:

	Motor	Steamer
Deadweight tonnage	3,500	5,000
Fuel oil 45 days, 5 tons day..	225	....
Coal oil, 45 days, 25 tons day.	....	1,125
Water for boiler	....	100
Net paying cargo in tons	3,275	3,775

Weight of motor ship 70 percent of steamer.
Carrying capacity 87 percent of steamer.

It must be kept in mind, however, that the motor ships now in use are nearly all of the merchant marine type making from 7 to 9 knots and are not fast running vessels. But the merchant marine is operated for economy of transportation and the hull that can carry the most cargo at the least cost is considered the best. The fast passenger steamers of large size, requiring in some cases nearly 100,000 horsepower will probably not be powered with internal combustion motors in the immediate future as the present difficulty of building diesel and other types of liquid fuel engines in sizes even as large as 1,000 horsepower per cylinder would mean an objectionable number of cylinders for the complete plant. Another difficulty is the prejudice of the average marine engineer in favor of steam. This is yielding slowly to the idea of internal combustion power just as the old sailor refused to give up the sail after the steam engine had come into common use in marine propulsion. However, the results obtained to date are so favorable that great advancement is looked for in the near future, and the fact that the internal combustion engine

* Professor, Colorado School of Mines. Paper read before Colorado Section, A. S. M. E., Jan., 1922.

has come to stay is being accepted by an ever increasing class of progressive marine engineers.

Among the greater problems connected with the design and operation of the oil engine may be mentioned the cooling of the working surfaces exposed to the heat of combustion, which may run between 3,000 to 4,000 deg. F. The intimate and thorough mixture of the air and fuel in a large cylinder is also a matter of some difficulty. As the diameter of the cylinder increases, the thickness of the walls must increase to withstand the same unit pressure. As the material increases in thickness the transfer of heat through the walls is retarded and a greater difference of temperature must exist between the two surfaces to drive heat through the walls. This difference in temperature is apt to cause a severe tension on the cooler side and compression on the hotter side. The fact that the temperature on the hotter side must be kept below the vaporizing temperature of the lubricating oil adds to the complexity of the problem.

Larger Engines Make Carburetion More Difficult

The subject of carburetion in a large cylinder is a very different problem than is met with in a small engine. Since one atom of carbon needs two atoms of oxygen to complete its combustion, if a few cubic feet of air are segregated in one portion of a large cylinder and the fuel is likewise partially segregated, the correct mixture is formed only along the lines of stratification, and imperfect combustion with loss of power is the invariable result. These and other difficulties which confront the large engine builder are never met in the small engine.

Whether or not the internal combustion motor will displace steam in the present locomotive is problematical. The difficulty of using and keeping in order huge clutches or other starting mechanism to start a heavy train from rest gradually has not been considered favorably by railway engineers and the gas engine does not possess the property of throttling the pressure in the cylinder to produce a slow yet positive effort as does the steam engine. The possibility of using an hydraulic clutch or similar flexible connector is not beyond present day accomplishment.*

The enormous cost of equipping a great railway system with an entirely new type of prime mover is a serious obstacle, and the education of the great mass of employes to operate and keep in repair a new class of machinery is a matter of considerable time, but like all other great problems it is only fair to grant that it is a matter which will receive a fair trial in time to come, and if the commercial returns are favorable it will be generally adopted.

Underground Haulage Not a Promising Field

Underground haulage is an industry in which the internal combustion motor will probably never gain an absolute place on account of the effect of the exhaust on the health of the miners and motor operators. The extra amount of ventilation necessary would in many cases be more expensive than the compressed air plant with its pipe lines and compressed air locomotives. Although there are many tunnels in which natural ventilation is good where the gas locomotive is now used to advantage, it is a case which calls for the judgment of those in charge.

Last but not least is the great benefit which the small gasoline engine has conferred on the rural communities. Thousands of country homes have been enabled to enjoy electric light and running water furnished by the gas motor as well as to churn, saw wood, grind feed, and perform various other chores which would be out of the question for a small steam plant with its constant need for a skilled attendant and danger of explosion.

In conclusion, it is the writer's belief that the motor car of the future will be capable of successful operation on the kerosenes and heavier oils on account of the gradually increasing cost and scarcity of gasoline, unless the refiners can find a way to crack and recrack crude oil until they can convert at least 80 percent of it into gasoline. This result has been predicted by some investigators in the art of refining and cracking.

The chief objection at present to the heavier fuel oils is the difficulty of starting a motor quickly on this fuel.

Many motor car builders are now working on starting devices for heavy oils and it is but reasonable to conclude that some one will produce a satisfactory device for this purpose in the near future.

Operator's Ignorance Still a Big Factor

The tractor builders have already produced kerosene motors which operate successfully, but it must be remembered that the demands on the tractor motor for quick starting, sudden bursts of speed and great variation in speed are very much less than the passenger car motor. One of the greatest obstacles with which the motor car builder has to contend is that so many automobile drivers know nothing of the mechanism of the power plant they pretend to operate, and what is worse they do not want to know. They demand a machine which is entirely automatic under all conditions of operation, and it is indeed a glorious tribute to the mechanical engineer that he has produced a machine which so nearly accomplishes this result.

While it seems that we have almost reached perfection in the automobile industry, the future will in all probability bring forth some startling results which are now unheard of.

The field of aviation is just in its infancy and it is in this branch of internal combustion engineering that we may look for evolution of a most interesting and surprising nature. It may well be said that an aeroplane is only as reliable as its motor, and the future of aviation will depend mainly upon the perfection of the motor in regard to its reliability, dependability, and endurance.

It is a great satisfaction to engineers to reflect that without the internal combustion motor many of our largest and most profitable industries would not be in existence today.

* The interested reader is referred to the splendid article by Elmer Sperry in a recent issue of this publication, covering the subject. Also the earlier articles on marine diesel engines.

Receiver for Defiance Company

The Defiance Machine Works, Defiance, O., has been placed in the hands of a receiver as a result of proceedings brought in the federal court in Toledo by the Chicago Screw Co., acting for itself and other creditors. E. M. Hammer, manager of the company, was named receiver. The complaint states that the company had a number of machinery orders amounting to about $1,000,000, but that the business depression resulted in a cancellation of many of these orders, leaving the company with large inventories and claims against other companies in financial troubles on which it could not realize. It further stated that the machine works has assets largely in excess of its debts.

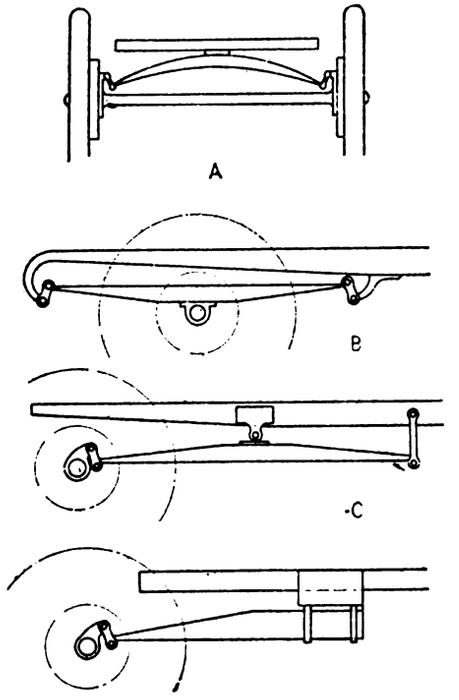
A Valuable Paper on Laminated Springs

One of the most valuable and practical papers amongst the many important contributions to the technique of motor design which have been presented to the Institution of Automobile Engineers (London, Eng.) was that read before that body recently. It dealt with the design and functioning of laminated automobile suspension springs, and was the work of Mr. A. A. Remington, a past president of the institution, who has devoted a great amount of time and experiment to this important question.

An abstract of the paper appearing in Auto Motor Journal follows:

The historical side of the question, with which the author dealt first, is of great interest, and the author traced it back to the years 1750 and 1790, when laminated vehicle springs first came into general usage. He instanced the semi-elliptic spring as being in a special case a beam, loaded at the center and supported at the ends, and pointed out that the condition of maximum economy was fulfilled when all the material is uniformly stressed. On the question of the periodicity of the spring this should not be more than 90 complete oscillations per minute.

Periodicities lower than this are preferable from the point of view of the period of oscillation, and are not objectionable except for the difficulties introduced in connection with mudguard and ground clearances and universal joint power transmission action. "Too low a periodicity has, however," says the author, "one very objectionable and little expected effect—namely, the reduction of the continuity of the adhesion between the wheel and the road. The adhesion that will cause slip or spin, either intermittent or continuous, for a given road wheel torque, is determined, on all but a perfect road surface, by the periodicity of the wheels and axle as between the elastic tire and the spring and a lower suspension period reduces the wheel period, lessens the adhesion, and consequently conduces to wheel slip."



SOME FORMS OF SPRINGS: A—A form of transverse spring. B—The usual form of semi-elliptic spring arrangement. C — The usual form of cantilever spring. D—Two half cantilever springs.

On the question of flexibility, the author pointed out that "the property of the steel that is called into play in a spring is its ability to bend, which is effected by stretching the fibres on one side of the blade, and compressing those on the opposite side to an approximately equal extent. It is probable that little, if any, actual stretching or compression takes place, most of the movement being due to alteration in form, rather than alteration in volume. When springs are loaded, so that the strain exceeds the limit of proportionality, the modulus of elasticity alters, and while it is probably constant for a given material, for any particular fibre stress * * * it is not the same at all fibre stresses."

On the question of internal friction, it was pointed out that the effect of friction between the leaves is to damp out the oscillations gradually. The author says: "The amount of friction in a laminated spring as ordinarily made is small, but it is useful in damping out oscillations more quickly than would otherwise be the case. It is doubtful if any considerable increase of friction, either by a modification of spring design or by the addition of shock absorbers, is desirable, except in extreme cases, such as on racing machines, where wheel adhesion and ability to hold the road take precedence over comfort."

Very interesting were the author's remarks as to resistance to rolling. Laminated springs, he pointed out, present considerable resistance to torsion, and he remarks: 'In this respect, the semi-elliptic spring is superior to the cantilever, as both ends of the former are effective, and as the greatest possible resistance to rolling is desirable, this lessened torsional resistance may be considered a defect of all simple cantilever springs." On the effect of mounting, we may be allowed to quote in extenso the very interesting remarks of the author which point to the elimination of the rolling of otherwise well-proved spring arrangements.

"Other factors remaining unchanged, the type of spring and the manner in which it is mounted have little effect on the suspension. The method of fixing or pivoting the springs on the frame, affects the resulting action, but only in so far as it modifies the degree of freedom or direction of articulation of the parts.

The usual forms of normal rear suspension can be expressed by four groups as shown:

(a) Tranverse spring fixed to the frame at the center, and linked to the axle at each end.

(b) Two semi-elliptic springs, one at each side, pivoted to the axle at the center and linked to the frame at each end.

(c) Two cantilever springs, each linked to the axle at one end, linked to the frame at the other, and pivoted on the frame at the center.

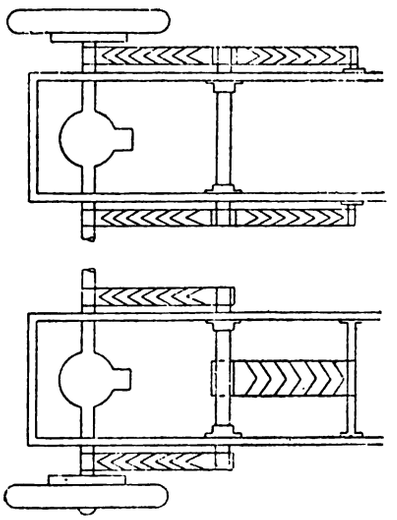
(d) Two half-cantilever springs linked to the axle at one end and fixed to the frame at the other.

These four forms of suspension make no difference to the external effect provided that the rate of deflection is the same, and that the axle is articulated in respect to the frame in the same manner, but they only modify the internal effect, particularly as regards the stresses and stress-distribution in the various members.

Articulation of, or interconnection between, the various springs, by altering the degree of freedom, affects the suspension, usually more particularly in the direction of degree of stability; for example, if in the case of group (a) the spring were pivoted on the frame at the center, instead of being fixed to it the suspension would lose all lateral stability, or resistance to rolling; and if in group (c) the springs, instead of being independently pivoted on

the frame, were interconnected at their centers by a shaft fixed to each of them and carried in bearings on the frame as shown in the fifth illustration, the suspension would not be altered as regards vertical movement, but would have enhanced resistance to rolling. This latter arrangement is covered by patents taken out by the author and in use by Messrs. Wolseley Motors, Ltd."

The author dealt with the question of eyes, and pointed out that in the best practice it is not unusual for the blade to be slightly thickened and widened at the eye for a short distance. The thickening reduces the tendency of the main blade to "give," and reduces the necessity for full length blades to support it.



The Remington-Wolseley patented arrangement, where the centers of the springs are inter-connected by a shaft fixed to them and oscillating in the frame.

The center bolt came in for criticism, and it was pointed out that, if reasonably small in diameter, it should be made of the finest steel to resist the shear strain.

On the point of the number of blades and their width, the author stated: "There is little indication that a multiplicity of blades makes a better riding, and therefore, it is probably best to adopt a length and breadth that will provide a spring with a moderate number of blades, and a thickness not much exceeding its breadth, as producing the most satisfactory spring."

The fixing of the spring (at its center) came in for consideration, and it was pointed out that it was advisable to avoid a sharp edge across which the spring has to bend. A considerable radius here was stated to be preferable, and necessity of clips always being tight wos emphasized.

Altogether, the paper adds considerably to the data and observed phenomena of spring construction and operation, and is worth the careful attention of the designer.

French Motorists Partial to Colors

Prices of motor cars in the French market have dropped, but are now well stabilized. However, the prices of French cars are high; even those of the newly developed 10-h.p. vehicles run from $1,000 to $2,000 at the present rate of exchange, which is at least twice the cost of a car of equal utility in America.

The demand for motor trucks is still low, owing to army stocks which glutted the market.

The automobile in France, until recently, has been little democratized; most car owners employ chauffeurs, which accounts for the relatively slow introduction of electric lighting and starting. However, at the present moment many more Frenchmen are driving their own cars, owing to the business depression; and they demand electric starters, gasoline tank indicators, etc.

The number of individual manufacturers has greatly increased, from 48 before the war to 60 after the armistice. At present they are working at only 20 percent of capacity and are turning out 53,000 cars per annum, as against a production capacity of 250,000. The eight-hour law, now in effect in France, necessitates an average of one year's working time of one man for the production of a chassis, which is evidenced by the fact that for 53,000 cars per annum 55,000 men are employed in the manufacture of chassis and parts, 15,000 on body work, and 10,000 on accessories, or a total of 80,000 men.

French cars, as a rule are more highly finished than American cars; and the French taste is not attracted by the somber black stock body of the American car. The average automobile factory in France does not build bodies; that is a specialty in France, and customers like to choose and design the bodies of their cars. Colors are freely used, and frequently two or more colors can be found on the same body.

To Boom Electrics During April Shows

With a luncheon, two conferences and a two weeks' exhibit, electric vehicle dealers in the New York metropolitan territory are planning to make April one of the most auspicious months in the history of the industry.

The show is scheduled for April 3 to 15 and more than 30 manufacturers have signified their intention of taking part. It will be held in the big showroom of the New York Edison company at Irving place and 15th street and there will be no charge for admission. During the first week street trucks ranging from 750 pounds capacity up to five tons will be shown. Passenger cars will also be displayed during this week. On April 9 the big fellows will give way to electric industrial trucks and the second week will be devoted to the demonstration of methods of handling materials at freight stations and in industrial plants. The accessory exhibit, which will include storage batteries, charging apparatus and electric control equipment will extend over both weeks.

The luncheon will be held at the Hotel Astor on Tuesday, April 4. The first electric vehicle conference will be held during the street truck show and problems concerning the operation of street trucks will be discussed. The second conference, held during industrial truck week will take up problems growing out of waterfront congestion and inefficient methods of handling materials in factories.

Report of Receiver of Standard Parts Co.

The Standard Parts Co., Cleveland, has made a profit, before depreciation and adjustment, during its 16 months under the direction of Frank A. Scott as receiver, according to the annual statement filed in the federal court in Cleveland. Net sales for 1921 were $7,223,033, or about one-third of those of the preceding year. This business resulted in a profit, before depreciation and inventory adjustment, of $316,289. Depreciation for the year was $398,341 and adjustments $204,348, resulting in a loss of $286,400. Including the last four months of 1920, total net sales for the 16 months to Dec. 31, 1921, were $10,451,881, and after allowance for depreciation and adjustment resulted in a loss of $492,825, or, if omitting the depreciation charge, a gain of $146,360.

The French manufacturers have agreed that a salon shall be organized in Paris this year, but the date is still in abeyance.

Arthur Mellville Ware

Arthur M. Ware passed to another life on March 20. He was president and treasurer of the Ware Bros. Co., Philadelphia, publishers of the Auto Vehicle Monthly, the American Fertilizer, and other publications, as well as catalogues, books, etc.

It was but a short time ago that the then president of the company, Mr. Ralston C. Ware, was called beyond. There is now a brother still in the business, the only surviving member of the so long well-known Ware Bros. and their Carriage Monthly publication—both titles to conjure with in the carriage trade of the long ago.

Of the three brothers, A. M. Ware was outstandingly the executive, the planner, the diplomat, and with it all a most charming man in his personal contacts. He leaves a wife, daughter and son. The latter no doubt will assume the father's burden and conduct the important business that has been built up through the years.

The brief time elapsing between the announcement of Mr. Ware's demise and our publication time makes it quite out of the question to do more than speak reminescently of the Wares, father and sons, and their influence on the vehicle trade—the old "carriage trade" of times past.

The father began his working life as a journeyman body maker, and it was to promote the interests of that craft in the carriage trade as a union that he began publication of a little journal. Like all manual workers he was better at his craft than at ventures in a new field. The little paper struggled, gasped and nearly fainted. Meantime the three sons were helping in the mechanical production of the sheet and by slow degrees getting it into form to look the future in the face. This future was inaugurated when the elder Ware retired in favor of his sons. The boys soon raised the title of Carriage Monthly and made a place in the sun for what was to become a strong support of the trade it espoused.

For a number of years there were but two journals in the carriage trade, the Carriage Monthly and The Hub, itself an evolution from Stratton's Carriage Maker's Journal. The Carriage Monthly through change of titles finally blossoming out as the Auto Vehicle Monthly, and The Hub through similar mutations becoming the Automotive Manufacturer.

But it was in the time of the heyday of the carriage trade (the word "carriage" standing as the general name for all horse-drawn vehicles in trade nomenclature) that the vigor of competition between the two strong leaders developed the Ware brothers into journalists as well as business men of the first quality and at the top of the family stood by consent, Mr. A. M. Ware. He was the leader of the clan, and a right good leader, too.

As the calendar of years added leaf to leaf, "A. M.," as he was familiarly called by those who discussed him, forged steadily ahead, building up a fine printing plant as well as a strong publishing business—and the rewards were what they ought to have been.

The business functions of the brothers were well coördinated. It was a strong working team. The Carriage Monthly became a power for good in the trade it served, and at that time The Hub and the Carriage Monthly were reflectors of great power in projecting the light and leading of a trade that expressed itself with such mechanical artistry that it made the American carriage in its various styles the leading product of the world.

The passing of the two Ware brothers will demonstrate how well they fulfilled their part of this mission when it becomes necessary to look about for the worthy successors who, report has it, are always standing about offering feet that are a ready and complete fit for the empty shoes.

As contemporaries of Mr. Ware we can feel better than we can express it how highly we valued him as a generous and broad-minded competitor, who always was just and liberal in motive and helpful if called upon to lend a hand.

We extend our earnest sympathy to those who mourn him.

Widening Distribution of Packard Stock

There are 3,844 holders of preferred stock of the Packard Motor Car Co. and 1,698 holders of the common stock, according to a report of Alvan Macauley, president of the company. The outstanding shares of preferred stock total 147,818 and those of common stock aggregate 1,888,314.

The widening distribution of ownership is indicated by the fact that nearly 56 percent of the preferred stock is in the hands of small holders, those owning less than a hundred shares. These investors number 3,658, or about 95 percent of the total number of preferred stockholders. Only 13 percent of the outstanding shares of this class is held by owners of more than a thousand shares each. The highest amount in the hands of any individual is 3,215 shares, or only about 2 percent.

Out of the 1,698 holders of common stock, 1,333 or about 78 percent, own less than a hundred shares each.

Stocks of Motor Cars in India

The motor situation in India is not favorable, as the market is still heavily stocked with American cars, and some of the banks seem slightly embarrassed by the amount of automotive paper which they are now carrying for Indian customers. The sale of cars on hand moves slowly, and imports of motor vehicles during January declined.

The general financial situation in India is still far from good. However, while uneasiness is felt on account of the political agitation which is now being carried on, crop conditions are favorable, and general improvement is looked for during the next six months. Competent observers believe that India is on the threshold of industrial development.

While big sales of automotive products can not be looked for at the present moment, it is believed that the potentialities of the market justify American manufacturers in sending representatives to India for the purpose of making a careful study of the field.

Discipline is more beneficial to a man than he is ever willing to acknowledge. When you make a mistake, take your medicine.

The employee who is not loyal to his employer is often among the first to complain of that employer's lack of loyalty to his help.

Difficulties and Requirements of Air Transport

BY FRANK SEARLE*

Some of the Patience-Trying, Time Consuming, Money-Wasting Matters Which the Commercial Aviation Promoters Must Meet and Overcome—From Actual British Experiences.

This article will supplement the one presented in a recent issue in which a strong case was made out for commercial air transport as a big money-making prospect, when rightly organized. That the prospect is not entirely rosy will be noted from the following recital of actual air transport experiences in Great Britain, written by the former manager of the A. T. & T. Air Line. Subsequent articles will present other phases of the situation.

AFTER three years of continuous experience in cross-Channel air transport of passengers and goods, it must be admitted that the sum total of the experience is failure, or if you prefer to call it so, the very qualified success ,of civil aviation. It is our business as engineers and managers, to end this failure, to complete this success, and I suggest that the right way to begin is to visualize as clearly as we can the essential characteristics of the problem, because when we have stated and analyzed these we shall see clearly what the obstacles are to their being met practically and overcome.

Essential Points of the Problem

These requirements are obviously of three kinds. First there are those proper to the vehicle you propose to employ; these group themselves naturally into the requirements of the engine, as a source of power, and the plane, both as a device for rising into the air, staying in the air, and descending from the air to the land in a satisfactory way; and as a commodious and pleasant vehicle for the accommodation of travellers. Next, bearing in mind that it is a question of transport we are considering, there are all the problems involved in bringing travellers from their homes to the flying machine before it starts, and delivering them from the flying machine, after it has arrived, to their final destination. And lastly—and it is these requirements which govern the whole problem—there is the question of giving that rapidity and certainty of service to the customer at a price which he recognizes to represent the advantages offered, and this without the apparatus and the organization costing more than the travellers are able to pay. Stated in another way, then, the requirements fall into three groups which should be called the technical group, the organization group, and the economic group.

The ideal airplane for civil transport must consist of an engine on which the undertakers of the transport service can rely, not only for steady work, but for long work at a reasonable maintenance cost. The vehicle it propels must take the maximum load with the maximum comfort, the limitation in each case being the speed, certainty and safety, without which air transport can never become a commercial success. And the cost and upkeep of both must be reasonable.

Our three years' experience of civil flying since the war show us that there is not in universal use today the engine which meets the requirements I have set out. The explanation is not so much that these requirements have not been understood as that at the time when civil aviation became for the first time a possibility, the argument for experimenting with makeshift gear was irresistible, the attitude of directors and others in aircraft manufacturing firms soon after the time of the armistice when they, in moments of apprehension, turned their minds to air transport. This apprehension must have been genuine and severe, knowing that the government aircraft orders were ceasing and that something would have to be done, and done quickly, if the huge factories were to exist even on a much smaller scale.

The Airplane's Expensive Origin

It must be borne in mind that at the beginning of the war the science of aviation was so young and the necessity for aircraft manufacturers were intensive productions, and from the beginning of the war to the end of it, were fostered on expensive lines; while at the same time the managements and technical staffs of other and more slowly developed industries were all fully occupied and necessary in their own particular sphere.

Another very great factor was that these intensive staffs were reared in an atmosphere of forced production with very little regard for economy either in personnel or material. It is not very surprising, therefore, that when they made their momentous decision to go into aerial transport they went ahead on what to them was their ordinary business methods, namely, of extravagance in men and material, and, instead of enlisting new men and material, carried on with what existed at the moment.

Their first thought seems to have been to transfer war machines and men to the transport companies, the majority of both being not only unsuitable but detrimental to the very progress they were so anxious to foster. The designers, too, who are the aerodynamic and theoretical people on whom we rely for flying efficiency, had not the advice of people with practical transport experience to guide them as to the requirements of a commercial transport service; they had only the advice of those whose experience was limited to war flying. The tendency of the designers themselves, quite naturally, was also influenced by their experience having been gained, one might almost say entirely, in the design of machines for war purposes. My critics will no doubt say that it is easy to be wise after the event, but if we examine the problem they had to solve it will be admitted that any authority on transport for profit would have provided different men and different machines.

A transport man would have at once gone into the daily overhead charges per machine, in which would be included such ordinary items as depreciation, insurance, interest on capital and management and office charges, and these, plus the net flying cost per mile, would give clearly the number of miles per day per machine which have to be flown in order to break even, assuming the average normal load of other forms of transport.

In spite of the ease with which such figures could have been obtained, at the time I went into business (which was

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12 months after air transport had been established), I was told by one of the highest authorities on flying—a man who had gained a very high reputation during the war, but who had only war experience and no commercial experience—that an airplane could only fly 250 hours a year. This means approximately 70 miles per day; therefore, at 50 percent load, a four-seater machine, carrying 1s 6d per mile per passenger, could not possibly earn sufficient to pay its overhead charges—this figure represents an £18 fare to Paris, at which price passengers could not be obtained. Nor could they be obtained at £15. At £10 they began to appear in small numbers, and at £6 we find signs of real interest. In addition to this, not having worked out and appreciated these fundamental figures, firms employed a far greater number of machines than were necessary to obtain even the above unsatisfactory figures. On the other hand, one must not lose sight of the fact that but for their heroic efforts and the colossal loss of their, and other people's money, civil aviation would not be where it is today; though had they found the money and given the problem to some firm who had been successful for many years in mechanical transport, it could have been today on a much sounder basis than it is.

The operation and maintenance of their machines was carried on with lamentable lack of knowledge. For instance, while they employed a vast number of machines for the services which were maintained and on which the overhead charges went on daily, there was a very serious shortage of spare parts and spare engines, and, in consequence, machines were lying idle while their engines were being repaired, which meant that they were not only losing their earning capacity but that the overheads of about £4 per day per machine were going on for two or three weeks.

Again, little or no equipment was provided for doing repairs and inspections expeditiously, whereas a small capital outlay in this direction would have saved hundreds of pounds in labor.

Again, at this period the meteorological information was mostly too late and too meager to be of real service, and the wireless installations were very ineffective. It was the same with the air ministry as it was with the companies—they had not the experience to differentiate between the essentials and nonessentials of air transport, and consequently often spent money unwisely from this standpoint. One must admit that the air ministry worked exceedingly hard in the interests of air transport, but they were guided by chance and not by experience, and I feel sure there must have been someone in the marine or road transport business who could have given them the guiding principles of their own business which would have been useful in air transport.

In the past air transport companies were in the habit of carrying all their passengers and goods to and from the airdrome (which cost them over 1£ per head or 10 percent of the fare), and also of giving 10 percent commission to the various travel offices for booking a passenger by air. This again is excessive, and such offices should not expect more from air companies than from railway or steamship companies; in fact, in order to foster the business, they should be prepared to accept less. It is these heavy unnecessary charges that must go, otherwise air transport must fail.

Now with regard to air passenger organizations. The circumstances proper to all other forms of transport are proper to transportation by air. Nobody would make a success of the finest and fastest Atlantic steamer service that science can conceive or genius supply if the rapid and luxurious ships, we suppose in existence, started from some inaccessible port in England and arrived at some destination in America extraordinarily inconvenient to those who wish to go to the centers of population. It is not a counsel of perfection; it is simply axiomatic that the airplane, like the express train and like the steamship, is not a self-sufficient vehicle as, for instance, is the motor car. To get to the train you have to use a carriage or car to take you to the station; when you arrive at your train destination you have to have another vehicle to take you home. If you leave England and live in London you have to take a train to the port from which the ship starts. If you arrive in New York and your destination is Chicago, you have to take a train from New York to Chicago. In the first case the carriage and the cab, and in the second case the train service, are integral factors in the journey. Now so far as civil aviation is concerned, we have neither in England nor in Paris a starting and landing point for airplanes which is served by cheap, commodious and punctual train service; for that matter they are not served by train services at all. Secondly, to go back to our first comparison. If you are going from London to Liverpool, and thence from Liverpool to New York, you can drive in a closed carriage to Euston where there is a comfortable station and waiting rooms affording complete protection from the weather, and when you get to Liverpool the train runs alongside the steamer and you go along a covered gangway to the ship. It is only a few years since the trains started running alongside the ships at Liverpool and other ports, but it was realized what an important advance it would be, and how much such a service would add to the comfort of passengers. You can hardly expect the air service to be as comfortable as the train service until some such amenities as these exist at the starting and landing place. At present there is no means of getting to the aviation ground at Croydon at all except by car, and arrived there, there are neither waiting rooms nor conveniences of any kind for the comfort of the passenger, and he has to work many hundreds of yards, often through slush and mud, before he reaches the vehicle in which he is to spend two hours nursing his sodden feet to Paris.

I mention only the rudimentary shortcomings of the air service as it exists today, but obviously we cannot hope for flying to be a regular feature of normal traveling life unti lthis form of traveling includes—I will not say the luxuries—but these mere mitigations of discomfort which we all take for granted when traveling by train or steamer.

Importance of Terminal Connections

And here another point must be considered. One of the fundamental troubles in connection with flying today is not only that the traveller has none of the comforts and conveniences that he is accustomed to in other forms of travelling, but he is put to enormously greater expense because of the absence of facilities which surely could be supplied without undue cost or risk. It is, in my opinion, simply absurd that there should not be a regular service of trains to a platform running alongside the plane at the airdrome, so that within a quarter of an hour of saying good-bye to his friends in London the traveller should be seated in his airplane and ready to start; and that there should not exist in Paris a service of exactly the same nature. Apart from all other question, this provision for

the comfort of the traveller is an indispensable condition of successful commercial flying.

The question at once arises as to who is going to provide the railway facilities to the airdrome. In the first place, an airdrome should not be chosen which is cut off from the outer world either by distance or lack of communication, and if the ideal airdrome necessitates such glorious isolation, then the government must subsidize some railway company to provide the necessary connection. But for the government to choose an isolated spot for an airdrome and then subsidize air transport companies by a subsidy on gross takings from passengers who cannot get there is, of course, absurd.

Now when it comes to the economic side of flying, this obviously is a question of balance between receipt and costs. The circumstances that define the most economical form of ship or train or motor car are the same as those that define the desired features of an economical airplane. The speed must be such as to give an overwhelming advantage over any other form of locomotion. But it must be speed consistent with carrying a considerable load at a running cost which is not excessive, and it must be speed that does not demand either excessive first costs of engines and airplane or excessive upkeep. On these points we have learned a great deal in the last three years, but I venture to say that we should have learned more if the public authority for dealing with flying had been composed of individuals more familiar with the problems as we see them in this room, and less influenced by experience and problems of a totally different nature, namely, those propounded by aviation during the war.

Commercial and Economic Experience

There are some very brilliant young men at the air ministry who are most thorough and conscientious in their work; but when one deducts their negative commercial and economic experience of the war, one finds that experience with them cannot be expected. And in a few cases, after deducting their negative war experience, they could not have had more than the meager engineering or technical training of an apprentice or pupil.

These men in many cases have the power to dictate as to design and details of operation, and companies have no appeal from their considered opinions which are invariably based upon war experience and R. A. F. training. Every official in the technical branches of the air ministry should be an engineer of good training and undoubted experience excluding his war service.

I should also like to mention the examinations for ground engineers. These are verbal examinations, and are therefore the most difficult to organize, and from what I have seen, they have a tendency to follow that unsound policy adopted temporarily years ago in some of the board of trade examinations for the marine engineers' tickets—it is that of trying to "catch" the applicant by trick questions instead of thoroughly ascertaining his education, experience and knowledge. An example seen in the air ministry was a stretching screw—or turnbuckle—which had both ends screwed to the same hand; and the applicant was asked to examine it and state where it was faulty. I suggest that such "catches" are not a reasonable test either for education, experience or knowledge, which all goes to indicate that the examiners do not quite realize the essential qualifications of the holder of such a ticket, and I consider that the examination papers for the applicant for these tickets should be laid down by the committee to which I have referred.

The wireless on this side is good, but stronger liaison is required with the continent, where the wireless service even yet, after two years, is still practically useless, and direction finding must be developed to perfection along the whole of the Paris route without delay.

Flying in Thick Weather

Some organization would appear to be necessary for flying in mists and clouds, in that on the organized routes machines flying in opposite directions should have different ranges of altitudes. This, I think, is where the committee previously referred to should make some recommendations, and it is most important that the meteorological office should collect information from machines in the air and distribute it within a few minutes, when the information would be of great practical value.

The time must be fairly near when emergency landing grounds will not be required, but I think that for two years more the air ministry should maintain two landing grounds between Croydon and Lympne, and they should insist upon the French providing one near Abbeville and another near Beauvais.

Airplane and Engine Design

I will now turn to the subject of airplanes and engines and the first remark I will make is that manufacturers must guarantee their productions for a reasonable period after delivery; the guarantee must include the risk of parts having to be redesigned owing to faulty design in the first place. It is no use of a manufacturer selling a batch of engines and after three months admitting that the compression is too high and offering to supply new sets of pistons for £60 or £100 per set; and then after another three months admitting that the connecting rods are of unsuitable design and refusing to replace them except at the cost of over £200. I can only say that those manufacturers who are not prepared to guarantee their goods for the purpose for which they were purchased will be left without orders as soon as opportunity occurs. I am glad to say that there are signs of some manufacturers of machines taking some of the responsibility for their design.

In the interest of aircraft manufacturers I should like to sound a modest note of warning to the effect that they should not let history repeat itself by forcing the air transport companies into manufacturing their own machines, due to high prices, as has been the case with other forms of passenger transport. They must bear in mind that it is difficult for a manufacturer to retaliate, since he must make his machines suitable for as many markets as possible and therefore cannot specialize.

To my mind the price of the present day machine is altogether too high, although efforts seem to have been made to reduce the price. With the present wood construction, which still presents outstanding advantages, I am sure a lot more can be done. The all metal machine seems as far off as ever, and I doubt very much whether it will ever be nearer than a composite of metal and wood.

Notwithstanding the many times I have expressed my candid views on such questions as engine installation, cowling, controls, etc., I find very little improvement today in most of the latest designs of airplanes; and the war-type practice in many cases appears very deep rooted.

Also there still appears to be a strong tendency in design to put appearance, in the way of pleasing exterior lines,

before utility and service. In the design of the various metal clips and fittings on our airplane I plead for the use of ordinary commercial mild steel plate, which after working requires only the crudest annealing. In speaking of the propeller, I think that it is time a weather-proof propeller was in transport service. A metal propeller fills the bill if it does not weigh too much or absorb too much power, but I think we are on the wrong lines still trying to use a metal tip onto a wood propeller, which twists and stretches all the time it is working.

The continued use of the pneumatic tire surprises me. I feel sure that a solid tired wheel can be designed which will transmit safely all the shocks and forces to the undercarriage damping gear, and yet not be too heavy. The Germans used wooden tires during the latter part of the war. My critics will now tell me that they soon changed to pneumatics whenever they could get them. This is true, but one must bear in mind that the German undercarriages are not as shock-absorbing as ours, and the fact remains that the German wheels stood up very well.

On the subject of engines, my chief complaint is the cost of the engine and spare parts. I give a few examples and comparisons. One of the best known modern airplane engines costs £6,000 per ton. Complete machinery, including boilers and all auxiliaries, for a 35-knot destroyer costs only £200 per ton. Complete machinery, including boilers and all auxiliaries, for a 25-knot cross-channel vessel costs about £90 per ton. I am told that the reason for the high cost of the airplane engine is due to the expensive material and the still more expensive testing and heat tratment. If this is a fact then we must sacrifice 20 percent of the engine weight and get down to an article which will appeal to the commercial engineer, an engine which will run 30,000 miles without overhaul, and I am sure that one giving such results could soon be evolved if the type tests for these engines were made on the time table basis. I suggest that three 3-hr. stretches a day with one hour's interval between, during which time the engine must not be touched; the engine to start at the same hours every day until 300 hr. is reached, 10 minutes being allowed before the time table time for starting and warming up to full power. The three-hour stretches should comprise 10 minutes at the start at full power, then 75 percent full power for the remaining 2 hr. 50 min. The engine that can stand up to this test, even if its price is not lower than say 25 percent below present prices, will fill the bill.

The Auto Minus Brass

Before the war the automobile industry had always used a fair quantity of copper, brass and bronze. During hostilities on account of scarcity they were replaced by substitutes. Because of their cheapness the use of these substitutes has continued. Coincident with this substitution has been the enormous increase in the automobile repair business out of all proportion to the increase in the number of cars.

The absence of copper products is particularly noticeable in the rapid deterioration of cars in cities where subjected to the corrosive influences of salt air, gases from industrial plants, the use of crude oils, and various dust laying compounds on roadways undoubtedly contribute to this result. The effort to keep prices down by the employment of cheap materials in structural and working parts is poor economy to the owner. It is reported that the American car which utilized in its construction the largest amount of copper and brass products had been acknowledged by European engineers as the best car in this country, and during the war was the choice of one of the allied governments for high grade duty.

The New Motor Fuel

An enforced situation in Germany a few years ago, brought about by the interruption of importation of petroleum and petroleum products, reflected a condition which the world will eventually face universally, and resulted in the search and discovery of substitutes which were able to take the place of gasoline and lubricating oil in particular. This work has been described in Auto-Technik and Revue des Produits Chimiques. The Germans fell back on coal tar from which they obtained benzol and napththalene. The former has been used as a motor fuel for some time in admixture with alcohol and gasoline. The latter, when treated with hydrogen in the presence of the catlyst nickel, gives a series of products, one of which, known as tetralin, has been used recently with great success in the operation of automobile engines. The results obtained were even better than those ordinarily secured with gasoline as the fuel, for tetralin has a high specific gravity and a much greater calorific power than gasoline. Per kilogram, this is 11,600 calories for tetralin against 11,000 for the best grade of gasoline. The tetralin is not used alone but in admixture with alcohol and benzol, in the proportion of two of the latter and one each of the former. The ordinary form of carburetor may be used, but it must be adjusted to give increased admission of air, and it is advisable to preheat the fuel with the waste heat from the engine before allowing it to enter the cylinder. It is possible to start an absolutely cold engine with this composition fuel. The mixture will not foul the spark plugs. A test was made with the fuel on a standard make of car in Germany, which was run a fixed distance. The regular type of carburetor was used, the same one in each test. The tetralin fuel ran the car for 20 miles to the gallon, while the gasoline fuel ran it 12 miles per gallon under identical conditions. This indicates an increased efficiency in favor of the new fuel to the extent of 66⅔ percent. The speed of the car reached 55 to 65 miles per hour.

Italian Auto Industry 43 Percent Normal

Thirteen of the most important Italian automobile manufacturers are located in Turin. Their present production is approximately 43 percent of normal, which is accounted for by the present economic condition of the home market and particularly by conditions affecting the foreign markets.

Italian automotive manufacturers, when operating their plants at normal, are required to export from 65 to 70 percent of their annual output, as their home market can not absorb the total production. The reduced demand abroad, together with high protective tariffs, is chiefly responsible for the curtailment in export shipments. Spain is one of the best markets that has been lost to Italian manufacturers, owing to high tariffs.

The local annual circulation tax imposed in Italy, calculated on the horsepower of the motor, influences to a certain extent prospective buyers. A 10 h.p. car would pay an annual tax of 520 lire, while cars with 50 h.p. or more would pay 15,000 lire for the annual license.

Aerial Mapping and Photography to Save Enormous Sums

(Continued from Page 10)

one has a detailed history much easier to look at than musty diaries or old forgotten town hall records. This thought has penetrated the real estate business and offered it vast possibilities. The possibilities are as effective as the strength of the camera itself which, due to the recent improvements, is now able to penetrate the thick blue haze which hangs over many cities almost continuously, and from high altitudes secure detail.

Another use for the aerial camera is the line map. The aerial map can be easily made into a line map by eliminating nonessential details, and it is being done wherever occasion requires.

Within the last few days Fairchild has completed arrangements with Laurentide Air Service operating for the Laurentide Co. of Grand Mere, Que., to plot and develop aerial photographs of 1,500 square miles of their timber holdings in the north country. From the aerial photographs, the foresters can count the number and tell the approximate size of the various kinds of trees. They can see burnt over, blown down, and cut over areas. They can literally do their lumber cruising in the office, quicker and at less expense than by the old method of sending timber cruising parties through the forest. The aerial photographs will be used as a check on the work done, to make sure that all cut timber is drawn out.

Aerial photography will increase in use and importance until it is an everyday part of routine business just as ordinary photography is employed by every business and industrial institution today. This development will constitute one of the principal functions of the airplane. Not only will aerial mapping and other kinds of aerial photography come into general use among civilians but also with governments. If it were to be used only for pioneer work, such as the preliminary surveying of the vast unchartered areas here, the aerial camera would have steady and continuous employment for a score of years. Aviation authorities credit it with being one of the most progressive and profitable branches of aeronautics today and one which will develop with considerable rapidity.

Improvement in the Argentine Market

The past year has been a poor one for the automobile business in Argentina, particularly affecting the importation of American cars. Only 723 passenger automobiles and 121 trucks were imported during the year, or about 5 percent of the imports for the year 1920. These figures do not include the lowest-priced American cars, which are brought in knocked down.

The year 1921 began with a stock of approximately 3,500 automobiles in the Buenos Aires custom house. More than half of the 1921 imports were entered during the first three months of the year and were on old contracts. Sales improved at the opening of the spring season in September, and the stock of cars in the custom house was withdrawn by the end of the year. Importations have now been resumed, although sales this summer (December, January and February) are on a reduced scale, due to the lack of ready money. There are few sales of high-priced cars. Of the total passenger cars imported during 1921, American cars numbered 426 and 297 were European. Of the total, 121 trucks imported, only 5 were American, most of the others being German.

New Patent Measure Now a Law

President Harding has presented to Edwin J. Prindle, chairman of the patent committees of the Mechanical Engineers, the pen with which the patent office relief bill was signed. Mr. Prindle, a New York lawyer and engineer, led the fight for the engineers in their nationwide campaign to wipe out archaic conditions in the patent office.

Manufacturers, inventors, scientists, lawyers and other classes joined in the movement, the success of which was described in an engineering announcement as a "great stimulus to the production of American inventions, which is the chief object of our patent system.

The pen was forwarded to Mr. Prindle by George B. Christian, jr., secretary to the president, and at the same time came a letter from Thomas E. Robertson, commissioner of patents, in which he pointed out that the patent office victory, won after 4 years of effort, signalized an outstanding achievement in the public interest. Engineers said that the passage of the patent measure relieved a situation which menaced American industry and invention.

Mr. Prindle explained that the new law added $451,000 to the payroll of the patent office, increasing the salaries of the examiners approximately 45 percent and the number of examiners 10 percent. "The bill," he added, "also contains an amendment to the patent law which will make a money recovery possible in all patent infringement cases where the patent has been held to be valid and there has been any substantial use of the invention. Heretofore the rules governing accountings in patent infringement suits have been so technical and illiberal that a money recovery has been impossible in most cases.

"Recently a few decisions have been rendered in which a more equitable principle has been applied to a limited class of infringement cases. The amendment makes the said principle statutory and extends its application to all classes of infringement cases.

"This amendment, which was proposed by the chairman of the patent committees of the American Engineering Council and the American Society of Mechanical Engineers, has been approved in principle by a number of United States judges, and no judge has disapproved of it. It is believed that it will prove a great stimulus to the production of American inventions, which is the chief object of our patent system."

Engineers said that relief came at a time when the patent office should have been responding to depressed industrial conditions. They saw in it an augury of better times. The patent office is practically a year behind in its work and there are now 65,000 applications for patents upon which the first official action has not been taken.

A long step, it was said, has been taken toward retaining America's industrial supremacy as well as agriculture, for the genius of the American inventor has been quite as helpful to the farmer as to the manufacturer.

Kentucky Had First State Road Policy

"In 1821, when Abraham Lincoln was a boy of 12, the people of Kentucky inaugurated the first state road building policy ever conceived in these United States," according to Edward S. Jordan of the highway committee of the National Automobile Chamber of Commerce speaking recently at the University of Kentucky.

Wide Awake States Are Keeping Highways Clear for Use

(Continued from Page 15)

of this make, provides the required power and through power drive on all four wheels, adequate traction.

This particular job, shown with a dumping body in the fully dumped position, has a wheelbase of only 105 in., which gives it an exceptionally short turning radius and makes it valuable as a time saver in making turns on the narrow grades without the difficulties often encountered with trucks of the long wheelbase type. This truck is designed to carry a 3 batch body of 3 tons capacity, the body to be operated by a horizontal hydraulic hoist and the tail gates to be operated individually. The truck is also designed to be used as a tractor for trailing loads to the concrete mixers and for hauling road machinery. Its specifications are as attached.

Some Notes on the California Top*

The California Top represents the present-day culmination of a concerted effort on the part of body engineers in this country, to produce a really satisfactory type of convertible enclosure. This particular style took its name from the Pacific coast state since the development of a readily convertible open car was particularly demanded in California because of weather conditions peculiar to that region. Days are generally very warm there and demand the protection of an open top with ventilation unhampered by windows. The evenings, on the other hand, are accompanied by heavy dews and a relatively large drop in temperature which makes one uncomfortable in an open car. The car owners seldom wished to lower their tops, disliked the saggy appearance of the folding style and demanded something more pleasing to the eye. The body builders and designers recognized this demand for a more durable and satisfactory type of curtain and top than the customary folding type with celluloid lights and began the development of what has come to be known as the "California top."

The first step, taken six or seven years ago, was to construct a solid frame top of wood, covering it with artificial leather and using glass lights in the sides and rear instead of the customary celluloid lights. This top did not perhaps, represent any great improvement over the "one-man" top. It was more rigid, but the flapping, bothersome storm-curtains were retained and were loosely attached by means of fasteners or buttons. Nevertheless, these tops sold well. They were something different and since most of them were custom built, each particular owner had an opportunity to express his own fastidious tastes in form and color. The natural result of this self-expression was a conglomeration of designs and clashing color contrasts. The bevel-edge plate glass windows in the back and rear-quarter curtains were fantastic in shape and represented anything from a half-moon to a diamond or oval.

A few years later a top appeared which represented the next stage in the creation of the present-day California top. Its outline, shape and trimming closely resembled the type just described, but the curtains slipped or rolled up into the space between the top deck and the headlining. They were concealed in this way when not in use and made a fairly weather-tight enclosure when pulled down. There were several serious faults in this design however. The curtains carried moisture into the top when rolled up after a rain storm, causing the headlining to become moldy, with consequent deterioration. The celluloid lights were dried out due to the heat of the sun on the top, crystallized and become brittle, and were fogged so that vision through them was impossible. Although this type proved to be popular for a time, body engineers soon recognized it as a mere stepping-stone to the construction of something possessing the same utility but of greater durability.

A body builder by the name of Gould exhibited a closer approach to the ideal convertible top at the San Francisco Automobile Show in 1919. It was meant to fulfill the California demand for a top with permanent roof and glass windows which could be quickly stowed or removed. In this design, the windows slid back into a pocket formed in the rear-quarter window, and were concealed in this way when out of use.

This top can be built on any touring car or phaeton body. A set of sills is first screwed securely to the body top rails and from this foundation side quarters are screwed on to a slatted roof construction built up over bows. This frame is covered with the usual artificial leather or top material and the inside is lined similar to a closed car roof. The window frames are covered in the same way and, where space permits, a hinged wind deflector or ventilator is built-in between the windshield and front door.

Mr. Steinbeck described informally the construction and operation of the top, and answered such questions as were put to him by individuals in the audience.

* By Paul W. Steinbeck. Paper read before the S. A. E., in New York, Jan. 11, 1922.

Motor-Vehicle Exports from Germany

During December, 1921, 968 passenger cars, motor trucks, and chassis were exported from Germany, according to an unofficial report received in the automotive division. They were distributed as follows: Holland 21.5 percent, Belgium 17 percent, Sweden 9 percent, Spain 9 percent, Denmark 8 percent, southeastern Asia 6.6 percent, South America 2.7 percent, United States 2.2 percent, Switzerland 1.6 percent, Austria 1.5 percent, all other countries less than 1 percent each.

Compared with November, the December exports show a slight decrease. However, the total weight of the 968 cars exported during December exceeds by far the weight of the 1,000 cars exported during November, from which one may assume that more trucks were exported during December.

Export figures for the four months, January to April, 1921, have not been published. The total number of cars exported from May to December amounted to 5,810.

Philippines a Potential Market

In normal times there is a considerable demand for motor trucks, both in the city of Manila and throughout the islands, owing chiefly to the extensive system of highways over which the products of the country can easily be moved.

While at present the market for automotive products is overstocked and business in general depressed, there have been indications during the past few months that the situation is about to show improvement and that the Philippines will again develop into a satisfactory market for both motor trucks and passenger cars.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Glenwood Motor Car Co., organized by Cleveland interests, has purchased a 15-acre tract along the Y. & A. R. R. in Youngstown, O., where it plans to build a plant in the spring for production of a six-cylinder automobile. Initial unit will be a standard structural steel factory building 90 x 750 ft. During the first year of production, the company plans to turn out 500 cars, and at the end of the first 12 months to go on a five-car-a-day basis. Officers are: B. J. Cline, president and general manager; Capt. R. L. Quiesser, president of the R. L. Quiesser Co., Cleveland, secretary, and T. D. Lamb, president of the Hess Body Co., Cleveland, treasurer. Mr. Cline has had 22 years' experience in the automobile industry, and was formerly identified with the Chandler and Chalmers interests.

Wood-Gorrie Motors, Ltd., a newly incorporated company, formed for the manufacture of the Warwick light six car in four models, has selected St. Thomas, Ont., for the location of its plant, according to an announcement made by the Chamber of Commerce of St. Thomas, Ont. It has engaged temporary quarters in the factory of St. Thomas Boxes, Ltd., which will be used as an assembling plant. Negotiations are underway for the purchase of a 25-acre site, in the new industrial area. W. B. Wood, Toronto, is president of the company; A. J. Gorrie, Montreal, vice president; C. R. Collard, Toronto, secretary-treasurer, and W. H. Smith, Toronto, chief engineer and designer. At the outset the company will be an assembling concern only, using standard automobile parts.

W. C. Durant, president Durant-Motors, Inc., 1819 Broadway, New York, is arranging for the manufacture of a complete four-cylinder, five passenger automobile to sell for $348. Plans will be developed at an early date for facilities for quantity production with a number of branch works in different parts of the country for assembling. It is understood that the car will be handled by a separate organization, the Durant company contracting for the production only. The regular Durant automobile is now being manufactured at the Long Island City plant of the company, which is operating full under a daily production of 100 cars, and the new automobile will have no connection with this plant.

U. S. Tractor & Machinery Co., Menasha, Wis., at its annual meeting authorized an increase in capital stock from $500,000 to $1,000,000 and a bond issue of $250,000 to provide for the construction of a new foundry and additions to the machine shop, assembling floors and storage buildings. These will enable the company not only to manufacture practically all parts of its tractors and tractor implements, but to enlarge the line to embrace other power farm equipment. Officers were reelected as follows: President, J. M. Robinson; vice president, G. D. Harris; secretary, Joseph G. Sailer; treasurer, A. B. Jensen. Plans are in preparation and it is hoped to start construction work by April 1.

Six Wheel Truck Co., Fox Lake, Wis., which for several months has been negotiating with business men's associations for a permanent location, has decided to retain its establishment in Fox Lake and will begin work after April 15 on a one-story brick and concrete factory, 50 x 110 ft., estimated to cost $50,000 with equipment. For the past four years a small experimental shop has been maintained for the development of a heavy duty motor truck with dual sets of rear wheels, designed by F. N. Pettegrew, president of the concern.

Ford Motor Co., Detroit, Mich., will commence the erection of its proposed tractor plant at Green Island, N. Y., early in May, for the manufacture of Fordson tractors, motors, and other automotive products, estimated to cost in excess of $750,000, including machinery. It will give employment to about 10,000 persons when running full. Construction is well under way on a hydroelectric generating plant for works operation, estimated to cost $2,000,000. Machinery installation will commence in the spring and it is expected to have the plant ready for service in June or July. Stone & Webster, 147 Milk street, Boston, are engineers.

C. A. Shaler Co., Waupun, Wis., manufacturer of vulcanizing and tire repair apparatus, headlight lenses and other automotive specialties, sustained a loss of close to $350,000 by fire March 2. The factory, equipment and warehouses are practically a total loss. C. A. Shaler, president and general manager, at present in California, telegraphed March 3 to prepare immediately for the erection of a new plant of fireproof construction, details of which are not yet available. R. B. Dunlap is secretary.

Bassick Mfg. Co., manufacturer of lubricators and automobile accessories, 361 West Superior street, Chicago, has purchased the one-story plant of E. Edelmann & Co., manufacturers of automobile specialties, 2638 N. Crawford avenue. The plant contains 63,000 sq. ft. of floor space and is served by the Chicago, Milwaukee & St. Paul R. R. The Edelmann company has leased space in the Krasberg building in East Ohio street, where it will move its factory and assembling plant.

Lincoln Tractor & Implement Co., which has been incorporated with a capital stock of $1,000,000 will establish a plant in Urbana, O., for the manufacture of tractor plows. It purchased the old plant of the North American Chemical Co., which will be enlarged by the erection of a machine shop, 100 x 250 ft., and a steel and gray iron foundry. R. T. Parish is president; George H. McCracken, vice president; Lawrence H. Norton, secretary, and Joseph Link, treasurer.

H. H. Franklin Mfg. Co., Syracuse, N. Y., manufacturers of automobiles, has arranged an appropriation of $5,000,000 for a new plant to manufacture a light four-cylinder, air-cooled automobile. A site at Eastwood, near Syracuse, is being considered. The company is said to be negotiating for the purchase of the plant of the Willys Corp., Elizabeth, N. J., never entirely completed. With such acquisition the proposed Eastwood plant would be deferred.

Birmingham Motors, Ltd., Peterborough, Ont., recently incorporated, has acquired the Canadian rights for the manufacture of the Birmingham car now being manufactured at Falconer, N. Y. The Hope plant at Petersborough, has been taken over by the company and manufacturing operations will be started in the early future. It is not the intention of the company to purchase any machinery or equipment at present.

Monroe Automobile Co., Indianapolis, recently organized, will take over the plant and business of the William Small Co., 33 W. 11th street, heretofore manufacturing passenger cars under the Monroe name. The new owner will make a number of improvements, and proposes to develop capacity production. William Small, head of the acquired company, will be sales manager for the new organization.

Ford Motor Co. Hamilton, O., plant, which has been engaged in tractor production, has been turned into a wheel manufacturing plant and is now turning out 300 sets a day. It is understood that the plans of the company call for an increase in the output until the entire production of 4,000

sets a day are made. The plant also manufactures locks for touring cars, 4,500 a day being the present capacity.

Ford Motor Co., Detroit, is arranging to operate power plants of sufficient capacity to provide for all of its works, and has plans under way for increased construction for this purpose. The plant of the Lincoln Motor Co., a recent acquisition, will also be operated by power from the River Rouge generating station of the company. The entire project is estimated to cost in excess of $400,000.

Auto Trimmers Supply Co. and Iron Products Co., both Michigan corporations, were absorbed by the S. L. Jackson Co., incorporated for $100,000 with $75,000 paid in. Officers are as follows: S. L. Jackson, president and general manager; J. D. Burke, vice president; F. L. Sutherland, secretary and treasurer. The location of the office and warehouse is 500 to 516 Congress street, West, Detroit. The company handles a complete line of automobile upholstery and top materials, automobile top and body hardware and also everything in the way of cap screws, semi-finished nuts, bolts, washers, woodscrews, etc.

Ternstedt Manufacturing Co., Detroit, builder of automobile body hardware, has added the International Metal Stamping Co., also located in that city. As a result of its acquisitions during the past year the Ternstedt company finds itself operating at the present time in five large plants and having a floor space of approximately one-half million square feet at its disposal, devoted to the manufacture of automobile body hardware. The company has been working full time during the past months.

Franklin Motor Car Co., Syracuse, N. Y., has addressed an inquiry to the Milwaukee Association of Commerce with reference to the proposed establishment of a new factory estimated to cost $1,000,000. A similar inquiry has been received from the Halladay Motor Corp. of Newark, N. J. Two manufacturers of power farm machinery, whose identities are not divulged, are negotiating with the new industries division of the Asociation of Commerce for suitable buildings or sites for new buildings.

Zeder Motor Co. has been incorporated and plans to begin the manufacture of the Chrysler motor car at the plant of the Cleveland Tractor Co., Cleveland. The Elizabeth, N. J., plant of the Willys Corp. was equipped for the manufacture of this car. The Cleveland Tractor Co. will continue the manufacture of farm tractors and it is not known as yet what additional equipment will be required for the manufacture of the motor cars.

International Harvester Co., 606 S. Michigan avenue, Chicago, will take bids at once, through Day & Zimmerman, 608 Chestnut street, Philadelphia, for its new plant on W. Wayne street, Fort Wayne, Ind., for the manufacture of automobile and tractor equipment, and machinery. The work has been held in abeyance for several months, and is estimated to cost about $500,000.

Cotta Transmission Corp., Rockford, Ill., recently incorporated, has taken over the business of the Cotta Transmission Co., manufacturer of Cotta transmissions, and will continue to produce the same line of constant mesh transmissions for trucks, tractors, buses and gasoline locomotives. No increase in plant space or equipment is contemplated at present.

Peters Motor Corp., Parker and Logan streets, Trenton, N. J., has purchased the former works of the Bethlehem Paper Co., Bethlehem, Pa., for a new plant, including parts manufacture, assembling, etc. Possession will be taken at once and equipment installed. It is proposed to give employment to about 50 persons for initial operations.

Hanson Motor Car Co., Atlanta, Ga., manufacturer of automobiles, is planning for an addition to increase the output from 20 to about 50 complete cars per day. It recently acquired the plant of the American Motors Export Co., Jacksonville, Fla., as a branch. The two organizations will be merged under the Hanson company name.

Defiance Auto Lock Corp., recently incorporated, 836 Hamilton street, Allentown, Pa., will manufacture patented locking devices for automobiles. At first the lock will be manufactured on contract. Later the company expects to have its own shop and will be in the market for stamping press, milling machine, lathe, gear cutter, nickle plating outfit and an acetylene welding outfit.

Cresent Truck Co., recently organized, will locate at Lebanon, Pa., on property of the Hunsicker Engineering Co. The two concerns are independent and the Hunsicker Engineering Co. continues to do business as in the past, as engineer, founder and machinist, manufacturing cars, forgings and special machinery.

Lucius Mfg. Co., Uhrichsville, O., has completed and placed in operation its plant for the manufacture of welded tanks for automobile and other uses. The officers are J. E. Smith, president; Alexander Robinson, vice president; C. E. Lucius, secretary and manager; John L. West, treasurer.

Parker Axles, Inc., 15th floor, Gotham National Bank bldg., Broadway and 59th street, New York, manufacturer of automobile axles, has awarded contract to H. K. Ferguson, 25 W. 43rd street, for one and two-story plant at Poughkeepsie, N. Y., 100 x 160 ft.

Los Angeles Automotive Co., Los Angeles, will break ground at once for its new one-story automobile manufacturing plant, 71 x 252 ft., at 1020 Towne avenue, estimated to cost about $100,000, including equipment. The Morgan Co., 206 Kerchoff building, has the contract.

California Car Co., Alexander Bldg., San Francisco, will soon commence the erection of a new plant at Martinez, Cal., for the manufacture of automobiles, estimated to cost in excess of $75,000. C. R. Manbert, 496 12th street, Oakland, Cal., is architect.

Hanson Motor Co., Atlanta, Ga., manufacturer of automobiles, has acquired the plant and property of the American Motors Export Co., Jacksonville, Fla., for a branch, maintaining headquarters at Atlanta. The capacity will be increased.

Hackney Brothers, Wilson, N. C., operating an automobile works, are planning to rebuild the two-story structure destroyed by fire Feb. 22, with loss estimated at about $110,000, including equipment and stock.

Saginaw Product Co., Saginaw, Mich., manufacturer of automobile equipment, will install new equipment in its machine shop. F. W. Mowbray is superintendent in charge.

Additional Notes of Body Builders

Standard Body Co., Angola, Ind., will establish a plant in Hicksville, O., for the manufacture of motor truck bodies. It has acquired a lease of the Goller factory and is installing equipment.

C. R. Berglund, manufacturer of automobile bodies, 2630 Wentworth avenue, Chicago, is taking bids on a one-story plant, 100 x 125 ft., on 67th street near Park avenue, to cost $75,000.

Rubay plants at Cleveland report that inquiries have increased and that production gained during March.

Baker R & L Co., Cleveland, announces that business has reached 50 or 60 percent of normal.

A Motoring Paradise

Paris must be getting quite a nice place for motorists. A week or so ago we recalled the interesting fact that horse traffic is to be barred from certain thoroughfares. Now comes the news that a policeman has stopped a pedestrian for walking in the middle of the Rue St. Lazare, and in due course the offender was fined. He was told, says the report, that the road was meant for wheel traffic, and that pedestrians must keep to the pavement, except when crossing from one side to the other. Excellent! We hope Paris will carry on the good work and even extend its law to the capricious dog. How old-fashioned our ideas must appear to Parisians!—Motor (London).

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are What They Are What They Are Doing

William A. Henderson, connected with the Dort Motor Car Co. as manager of the Kalamazoo (Mich.) plant, has entered the services of the Brooks-Ostruk Co., New York City, as president and general manager. For more than seven years he was with the Holbrook Co., New York, as factory manager in charge of designing, constructing and manufacturing. The Brooks-Ostruk Co. enjoys the reputation of builders of the highest class of automobile bodies and recently received world-wide publicity through having built the most expensive automobile body in the world. This was an armored limousine which is now in use in Mukden, North China, by Chang Tso-Lin, governor general of Manchuria.

John McConnell, whose contribution to the early development of alloy steels and to the growth of the present United Alloy Steel Co. was an important factor in that business, has rejoined that company as vice president in charge of operations. In the early days of the United Steel Co., which preceded the United Alloy, he was a leader in the production of vanidium steel in commercial quantities.

Francis W. Davis, one of the best known men in the automotive engineering field, has resigned as consulting engineer of the truck department of the Pierce-Arrow Motor Car Co. with which he has been associated for several years. Other than leaving on an extended trip to Europe he has announced no definite plans for the future.

F. E. Mosher has resigner as vice president and treasurer of the Covert Gear Co. of Lockport to become associated with the Dauch Chemical Co. of Louisville. Mosher is widely known in the industry, having been with the Covert Gear Co. for several years. His resignation is effective April 1.

W. H. Sackman who recently resigned as chief engineer of the Light Manufacturing & Foundry Co. of Pottstown, Pa., has been chosen a director and chief engineer of the Pennsylvania Gasoline Drill Co., of Philadelphia.

Earle T. Sutton, formerly advertising manager of the Denby Motor Truck Co. and having wide sales experience both wholesale and retail, has been appointed to the factory staff of the Signal Truck Corp., Detroit.

Albert Turner recently joined the engineering department of the Heald Machine Co., Worcester, Mass. Mr. Turner was formerly with the Norton Co., Worcester, where he was engineer for 19 years.

N. H. Van Sicklen, at one time publisher of Motor Age and latterly manufacturer of the Van Sicklen speedometer, has been appointed assistant general manager of Apperson Bros. Automobile Co.

John McConnell has again affiliated himself with the United Alloy Steel Corp. as vice president in charge of operation. He has been associated with the steel industry for a number of years.

A. M. Leoni, who until recently was connected with the Steinmetz Electric Car Co. of Baltimore, has joined the Electrocar Corp. of New York as consulting mechanical engineer.

J. Henry Smith has been appointed manager of sales of the automobile body department of the Pullman Co. with headquarters at Chicago.

Paul L. Battey, formerly vice president of the Arnold Co., Chicago, and for years chief engineer in charge of various industrial enterprises, including the Willys Corp. plant at Elizabeth, has established himself at 123 West Madison street, Chicago, as consulting engineer for industrial plants.

R. O. Gill, formerly production manager of the Packard Motor Car Co., Detroit, has been promoted to be factory manager.

Body Builders

American Body Co. of Buffalo has received a million-dollar contract from the Lincoln Motor Co. for the construction of bodies for its new four and seven-passenger cars. Filling of the contract is expected to take at least six months. The work will call for an additional force of about 300 expert body builders. The Buffalo plant is at present working on the first lot of orders. The product manufactured by the body company will consist of the body enameled, upholstered and equipped ready for attaching to the chassis.

Fisher-Ohio Body Corp. plant at Cleveland is now operating on a full time basis and is turning out 200 bodies a day. Practically capacity production is the schedule, with 2,800 men employed. About six months ago the plant was practically closed down, after having been in production with about 3,000 men the latter part of 1920. Last October production was resumed on a small scale and it has been increased steadily. Inquiries for bodies of the closed type have greatly increased.

Ohio Body & Blower Co., Cleveland, reports a net loss for 1921 after charges and inventory adjustment of $558,660, as compared with a net loss of $397,338 in the previous year. Net sales in 1921 were $1,531,468, as against $2,737,260 in 1920. The cost of sales, inventory adjustment, etc., reached a total of $1,601,397 in 1921, as compared with $2,479,540 in the year previous. The total operating loss was $391,568 in 1921 and $229,903 in the year before.

Martin-Parry Corp., York, Pa., manufacturer of automobile bodies, is perfecting plans for new works at Lumberton, Miss., for assembling and finishing automobile body base and top units. A complete saw mill and cutting up plant will be constructed in the same district by the Edward Hines Lumber Co., 2431 South Lincoln street, Chicago, which has taken a contract for material from the Martin-Parry company.

Mullins Body Corp., Salem, O., for the year ended Dec. 31, 1921, reports net operating loss of $87,617 after expenses. Net sales during the year amounted to $1,431,243. Gross profits from sales after deducting cost amounted to $130,061. After deducting miscellaneous charges of $23,227 and expenses $217,678, there was a deficit of $110,392.

Auto Body Co., Lansing, Mich., through a contract with Durant Motors, Inc., for the manufacture of open bodies has increased its operations. January's production was 85 percent more than January, 1921. About 400 men out of a normal force of 1,000 are now at work.

Ford Company's Los Angeles body plant is producing 30 sedan bodies daily. Entire annual production, estimated at 10,000, will be used in Los Angeles, where demand for closed cars has been increasing.

Barton Auto Top Co., 4445 Woodward avenue, Detroit, is completing plans for a new three-story factory, 62 x 160 ft., at 60 West Canfield avenue, estimated to cost $50,000. Albert Barton is president.

FOREIGN MANUFACTURING INQUIRIES

The following inquiries, offering manufacturing and merchandising opportunities, have been received recently and are offered to subscribers and friends of Automotive Manufacturer for what they are worth

806—The purchase and agency are desired by a firm in Spain for the sale of electrical vehicles, storage batteries, and electrical supplies for automobiles. References.

861—There is a market in Colombia for accessories and coach builders' supplies, such as wheels, lamps, rubber and steel tires, bells, carriage tops, whips, harness, and coaches such as are used in Colombia, chiefly of the small two-seated surrey type. Quotations should be given f. o. b. New York or New Orleans. References. Catalogs, literature, and discount lists requested.

870—A manufacturer in Spain desires to purchase machinery, parts and accessories for the manufacture of cycle cars. Quotations should be given c. i. f. Spanish port. Payment to be made against documents. Correspondence should be in Spanish. References.

871—Representation is desired by a commercial agent in Venezuela for the sale of hardware and automobile accessories. References.

883—A firm of commercial agents in France desires to secure the representation of firms for the sale of bicycles and automobiles; also to purchase a product to replace inner tubes in automobile tires; lighting signals and other automobile and bicycle accessories which might be adapted to use on French automobiles. Correspondence should be in French. Reference.

888—A firm of contractors and engineers in India wishes to secure exclusive representation of manufacturers for the sale of engines, tractors, motor trucks, lorries, bicycles and motor cycles, agricultural implements, general machinery and tools, hardware, window glass, lubricants, paints and varnishes, disinfectants, watches and clocks, photographic goods, drawing and surveying instruments, stationery, typewriters and other office supplies, chemicals, and colors. No reference given.

890—The purchase is desired by a mercantile firm in France of cylinder oil, automobile oils, and all qualities of oils, greases and paraffins. Quotations should be given c. i. f. Marseille, Havre, and Algiers. Shipments to be in barrel lots. An agency is also requested. Reference.

907—A merchant in Spain wishes to secure an agency for the sale of electrical machinery, supplies, and novelties in the electrical trade; and automobiles and accessories. Quotations should be given c. i. f. Spanish port.

916—The purchase is desired by a manufacturing firm in Japan of bicycles, parts, and accessories. Quotations should be given c. i. f. Japanese port. Payment to be made through bank in United States currency. References.

917—A firm of commission agents in Denmark desires to secure the representation of firms for the sale of tires and accessories for automobiles, as well as repair machinery and tools for repair shops, especially for the lower priced cars and trucks. Exclusive sales rights are desired on consignment commission basis in Latvia. References.

920—A merchant in Spain desires to purchase and also secure an agency for the sale of gasoline and refined petroleum, and stearine candles. Quotations should be given c. i. f. Spanish port. References.

944—An agency is desired for the sale of medium-priced automobiles by a firm of brokers in Chile. References.

950—An automobile salesman in Spain desires to purchase accessories for motor cars, such as shock absorbers, lamps (electrical and carbide), speedometers, motometers, top and slip covers, horns, and sirens. Quotations should be given c. i. f. Spanish port. Reference.

956—An agency is desired by a mercantile firm in Spain for the sale of articles connected with the automobile industry. Quotations should be given c. i. f. Spanish port. References.

964—The American representative of a firm in Italy wishes to secure an agency for the sale in Italy of motor supplies and accessories, lubricants, etc. Reference.

976—An importing firm in Spain desires to secure an agency for the sale of lubricating oil. Quotations should be given c. i. f. Spanish port. References.

982—There is a market in Spain for accessories for cheap automobiles. Quotations should be given c. i. f. Spanish port. Terms: Cash against documents. Correspondence should be in Spanish. Reference.

987—A general agency is desired by a merchant in Algeria for the sale of hardware and automobile tires and supplies. Quotations should be given c. i. f. Algeria. Correspondence should be in French. References.

1013—A commercial agent in Portuguese East Africa desires to secure the representation of American manufacturers for the sale of lubricating oils, paraffin, gasoline and general petroleum products. Quotations should be given c. i. f. African port. Reference.

1026—Inquiries have been received from firms in Spain desiring to purchase automobiles, motorcycles, and accessories. Quotations should be given c. i. f. Spanish port. Correspondence should be in Spanish. References.

1050—A mechanical engineer in Palestine desires to secure the representation of firms for the sale of low-priced American motor cars. Quotations should be given c. i. f. Jaffa. Terms: Cash against documents. Reference.

1068—An agency is desired by a merchant in Asia Minor for the sale of modern four-wheeled, rubber-tired carriages, one or two horse drawn, and extra supplies for same, such as rubber, leather, and oilcloth. Quotations should be given c. i. f. port of Asia Minor. Terms: Payment against documents at bank. Correspondence should be in French or Greek. References.

1070—The representation is desired by a mercantile firm in Palestine of American automobiles of the $1,000 to $2,000 class. References.

1074—A request has been received from an importing firm in Spain for the purchase and agency for leather goods and automobile accessories. Quotations should be given c. i. f. Spanish port. Correspondence should be in Spanish. References.

1086—A request has been received from a commercial agency firm in Spain for the purchase of general machinery and automobile accessories. An agency is also desired. Quotations should be given c. i. f. Spanish port. Correspondence is desired in Spanish or French. References.

1145—An inquiry has been received from a firm in Sweden which desires to purchase spare parts (not accessories) for all types of American automobiles. Quotations should be given c. i. f. Swedish ports. Reference.

1151—A firm of engineers in the United States, having connections with importers in Great Britain and France desires to secure the rerpesentation of firms manufacturing mechanical, electrical, and automobile specialties and patents. Reference.

The foreign inquiries are received mainly through governmental sources, and consequently some delay in reforwarding these must be expected. Answers should comply with the following simple rules: 1, Write one inquiry and only one on each sheet. 2, Give the number set against the inquiry below. 3. Write on your own business letterhead. Address, Commercial Inquiry Dept., Automotive Manufacturer, Heptagon Building, 153 Waverly Place, New York.

Lubricated for a Lifetime

The material from which the cam of the Westinghouse Type "SC" Ignition Unit is moulded was developed in the Westinghouse Research Laboratories. In this material, graphite is effectively incorporated.

As a consequence the cam requires no lubrication from an outside source and is certain, under ordinary conditions, to outlast the car on which it serves.

This cam typifies the attention given to details in the design of this new Westinghouse Standardized Two-Unit Battery Ignition, of which other outstanding features are the self-cleaning contacts, the waterproof, air-tight condenser, moisture-proof coil, and accurate electrical balance between coil and condenser.

These features are all illustrated in Circular 1606. A copy will be mailed you on request.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.
Automobile Equipment Department
General Sales Office, 110-114 West 42nd Street, New York City

Westinghouse
STANDARDIZED IGNITION FOR AUTOMOTIVE VEHICLES